



TECHNICAL MEMORANDUM
UPPER AQUIFER INVESTIGATION
MONITORING WELL AND SAMPLING
PROPOSAL

(REVISED ~~MAY 3, 1996~~)

July 25, 1996

AMERICAN CHEMICAL SERVICE, INC.
NPL SITE
GRIFFITH, INDIANA

PREPARED FOR:
ACS RD/RA EXECUTIVE COMMITTEE

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PREPARED BY:
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MAY 1996



MONTGOMERY WATSON

TECHNICAL MEMORANDUM

UPPER AQUIFER INVESTIGATION

ACS NPL SITE PRE-DESIGN

(REVISED: JULY 25, 1996)

This Technical Memorandum presents the results, conclusions, and recommendations from the Upper Aquifer Investigation conducted at the ACS NPL site in Griffith, Indiana between February 5 and March 4, 1996. The purposes of this phase of the Upper Aquifer Investigation are to: 1) delineate the approximate extent of groundwater contamination in the upper aquifer using temporary sampling points (i.e. hydraulic probes) and field screening of selected volatile organic compounds and 2), to propose upper aquifer monitoring well locations at the site to confirm the presence and absence of contamination. Groundwater samples were collected from 110 temporary sampling points with a hydraulic probe and analyzed for target VOCs using a field gas chromatograph (GC). The target VOC list included the most frequently detected VOCs in Site groundwater (benzene, ethylbenzene, toluene, xylene, chlorobenzene, 1,2-dichloroethene, and 1,1-dichloroethane). The results of the analyses were utilized to locate additional sampling points and delineate the extent of VOC contamination in the upper aquifer.

The Upper Aquifer Investigation was conducted in accordance with the Scope of Work and Specific Operating Procedures (SOPs) approved by U.S. EPA and in accordance with the draft Quality Assurance Project Plan (QAPP) and U.S. EPA comments regarding the QAPP. Investigation activities were divided and focused on four areas of the site labeled A, B, C, and D on Figure 1. These areas correspond to the following:

- A - Wetland Area West of the ACS Facility
- B - East of Colfax, South of Reder Road
- C - Southwest of the Griffith Landfill
- D - North and East Perimeter

Sampling locations utilized for the Upper Aquifer Investigation are shown on Figure 2. In this Technical Memorandum, objectives and sampling locations are initially presented according to area, followed by a summary of the sampling procedures utilized for the investigation. Results and conclusions for each area are subsequently presented followed by recommendations for completing the upper aquifer investigation and placement of additional upper aquifer monitoring wells at the site.

Although not included in the Scope of Work for the Upper Aquifer Investigation, three additional tasks were completed during the investigation and reported in this document. In response to U.S. EPA concerns regarding groundwater elevation data in the upper aquifer, top-of-casing elevations were resurveyed at piezometer P-52 and monitoring well MW-18 to verify the groundwater elevations measured in these wells. The resurveyed top-of-casing elevations for these two wells are 636.66 feet (NGVD) and 644.89 feet, respectively. The

Summary of Unconsolidated Aquifer Field Screening Results
 American Chemical Service, Inc.
 Griffith, Indiana

chk'd to 3/14/96	GP83	GPTB 1/31/96	GP84	GP85	GP85 Dup	GP86	GPFB 2/1/96	GPTB 2/1/96	GP87	GP87 Dup	GP88
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone									3900	3000	159
1,1 Dichloroethene											
trans 1,2 Dichloroethene											
1,1 Dichloroethane											
2-Butanone (MEK)											
cis 1,2 Dichloroethene											
1,2 Dichloroethane		44.4									
1,1,1 Trichloroethane											
Benzene									410	420	
Carbon tetrachloride											
Trichloroethene											
4-Methyl-2-pentanone (MIBK)											
1,1,2 Trichloroethane											
Toluene											
Tetrachloroethene											
Chlorobenzene											
Ethylbenzene									250	260	
m+p Xylene	16.7									32	
Styrene											
o Xylene											
TOTAL VOCs (ug/L)	16.7	44.4	0	0	0	0	0	0	4560	3712	159

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

You may also wish to contact the State Environmental Agency at the address below, for information they may have on file:

Mr. Thomas Linson
Indiana Department of Environmental Management
105 South Meridiana Street
Indianapolis, Indiana 46206-5015

The Records Management Center, located at the U.S. EPA Office, is open for the public viewing of certain site documents. If you wish to view these documents or have any questions regarding this letter, please telephone Audre Williams at (312) 886-6163.

Sincerely,

Carolyn D. Bohlen, Chief
FOIA Management Section

Enclosure(s)

cc: FOIA File
FOIA Officer, MI-13J

revised survey information for these two wells was utilized to plot the upper aquifer groundwater elevation presented in Figures 1 through 6. The groundwater elevation used for this plot was measured at the site on October 30, 1995. The resurveyed elevations for these two wells resulted in a minor change in the orientation of the contour lines defining the water table in the wetland area east of the ACS Site. The revised water table contour lines changed from a more north-south orientation to generally east-west, indicating that the direction of groundwater flow is more southerly than easterly in the wetland area.

The second task added during the course of the investigation was the identification of private wells located east of Colfax Avenue, and south of Reder Road. This information is included along with recommendations to sample four private wells on page 11.

The third task involved collection and field analysis of a surface water sample collected near piezometer P63. The analytical results of the surface water sample are presented at the conclusion of the document.

SAMPLING OBJECTIVES AND LOCATIONS

Area A - Wetland Area West of the ACS Facility

Direction of groundwater flow in the upper aquifer in Area A is generally to the west and southwest from the ACS facility. Because monitoring wells have not been placed to the west (downgradient) of wells MW-13 and MW-9 located at the edge of the wetland area, the extent of contaminated groundwater had not been defined in the area. The objectives of the Area A investigation were to:

1. Establish the line to the west of Area A which defines the extent of contamination as indicated by "zero" VOC concentrations (non-detect) in groundwater.
2. Determine whether VOC contamination extends below the upper five feet in the upper aquifer at selected locations along the plume front.

To accomplish these objectives, 22 shallow and eight deep upper aquifer groundwater samples were collected and analyzed for target VOCs. Sampling locations GP50 through GP71 and GP115 on Figure 2 show the locations of the shallow (five feet below the watertable) groundwater sampling locations. Deep groundwater samples were collected at a depth of approximately 10 feet below the watertable at locations GP50, GP51, GP52, GP57, GP66, GP68, GP70 and GP71 (Figure 2). The U.S. EPA has expressed concern that there may be a downward gradient in the upper aquifer. The purpose of the lower sampling level was to determine whether VOC contamination extends below the upper five feet in the upper aquifer. The U.S. EPA selected the sampling locations at the "apparent" downgradient edge of the plume. Sampling points were generally oriented in lines perpendicular to the north and south railroad right-of-ways at a spacing of approximately 100 feet between samples (based on field accessibility).

Area B - East of Colfax, South of Reder Road

The hydraulic gradient in Area B is generally to the south, with some southwestern orientation in the vicinity of a groundwater high near MW-18. VOC concentrations previously detected in wells MW-6 and MW-19 indicated that upper aquifer contamination may extend from MW-6 to beyond MW-19. (Monitoring well locations are plotted on Figure 1.) Prior to starting the investigation, several industrial facilities along the south side of Reder Road and a former UST located in the City of Griffith yard were identified as potentially contributing to the VOC contamination detected in MW-6 and MW-19. The objectives of sampling Area B included:

1. To define the outer extent of the VOC plume related to the ACS NPL site to the south and east of Colfax Road, on the south side of Reder Road.
2. To eliminate the potential that the industrial facilities contribute to the VOC plume detected at MW-19.
3. To determine if contamination from an area that contained an underground storage tank located west of monitoring well MW-6 is contributing to the VOCs detected in MW-6.

To meet these objectives, 45 groundwater samples were collected and analyzed for target VOCs. Sampling locations GP80 through GP89, GP116 through GP124, GP126 through GP136, GP143 through GP147, and GP150 to GP161 correspond to the sampling locations utilized for the Area B investigation (Figure 2). Sampling was generally conducted in areas near the former UST and the intersection of Reder Road and Colfax Avenue, in an area east of piezometer P61, and in grid-like manner south of a line between monitoring well MW-19 and piezometer P62. Except for samples collected near the former UST, the spacing of samples was approximately 200 feet wherever practicable.

Area C - Southwest of the Griffith Landfill

Because trace levels of VOCs were detected in MW-15, there was a question whether VOCs may be present in the groundwater outside the landfill zone between monitoring wells M-1S and MW-15. The hydraulic gradient in Area C is generally to the southwest (Figure 1). The objective of the Area C investigation was to determine if VOCs are migrating southwest of the landfill between monitoring wells M-1S and MW-15.

Seven groundwater samples were collected along the abandoned railroad right-of-way between Colfax Avenue and M-1S. Two additional groundwater samples were collected on private property located southwest of the railroad right-of-way. The sampling locations are designated as samples GP73 through GP79, GP148, and GP149 on Figure 2.

Area D - North and East Perimeter

Previous data collected in 1990 from the north and east side of the ACS site suggested that the outer extent of groundwater contamination was defined by a line extending from MW-18 to the south, approximately 200 feet east of MW-12, and to the northeast by MW-11.

Based on water level measurements collected in the area, the upper aquifer groundwater generally flows to the north from MW-18, northwest in the vicinity of MW-11 and flows westerly towards MW-13 (Figure 1). The extent of VOC concentrations around the north and east perimeter is apparently limited by the groundwater flow system in the area. The objective of the Area D investigation was to:

1. Confirm the extent of VOC concentrations in the upper aquifer around the north and east perimeter of the site.
2. Delineate the outer extent of contaminated groundwater in the upper aquifer.

Thirteen groundwater samples were collected in the area east of Colfax Avenue (samples GP90 through GP99 and GP101 through GP103) and 20 samples were collected north of the railroad tracks, north of the ACS site (samples GP100, GP104 through GP114, GP125, and GP137 through GP144). The locations of the samples are shown on Figure 2. In general, samples were collected in a linear fashion east of Colfax Avenue at a spacing of approximately 200 feet. In the north perimeter area, samples were also collected at an approximate 200 foot spacing as allowed by field accessibility.

PROCEDURES

Field Sampling

Upper aquifer groundwater sampling from the hydraulic probes was conducted in accordance with the SOP for the Upper Aquifer Investigation (revision: January 19, 1996) and in accordance with the draft Quality Assurance Project Plan (QAPP) and U.S. EPA comments regarding the QAPP with the following exceptions:

- The number of shallow groundwater samples collected during the Upper Aquifer Investigation in all of the areas was expanded to include additional sample locations. The total number of sampling locations increased from the 50 locations estimated in the Work Plan to 110 locations utilized for this investigation.
- The number of samples collected from a depth of ten feet below the watertable in the upper aquifer in Area A increased from the two specified in the Work Plan to eight locations, including six requested by the U.S. EPA during the investigation (GP52A, GP57A, GP66A, GP68A, GP70A, and GP71A).
- The originally planned "deep" samples were collected at GP50A and GP51A. Because a water sample could not be drawn through the hydraulic probe screen at the 10 foot interval, these samples were collected at a depth of 9 and 7 feet below the water table respectively.
- Sample GP115 was added at U.S. EPA request, between GP70 and the landfill.

- No samples were collected from locations GP131 and GP147 because water could not be drawn through the fine sand clogged geoprobe screen.
- Purge volumes were reduced for some low-yielding sample locations, including GP112, GP121, GP122, GP131, GP132, GP153, GP157, GP160, and GP161.
- The sample from GP54 was not analyzed because the odor and color indicated that it was contaminated. A groundwater sample was subsequently collected approximately 100 feet west of this location to delineate the extent of contamination (GP53).
- Two samples were collected from a depth of four feet rather than five feet below the watertable due to inadvertent placement of the slotted screen at GP91 and GP119.
- Water could not be collected from the five foot depth at location GP145, so the probe was driven and additional two feet in depth and the sample was collected from a depth of seven feet.
- A sample could not be collected at location GP72 because of cold weather conditions. A sample was subsequently collected in the same area, and identified as GP80.
- Two sampling locations, GP87 and GP90, yielded foamy samples, so zero-headspace samples could not be collected. The samples were brought to the field GC for immediate analysis from these locations.
- As a result of fine sand clogging the well point used in accordance with the SOP, water samples obtained from GP151 through GP161 were collected by advancing a finely slotted screen (0.010 inch slotted rod 36 inches long by 0.76-inch diameter) enclosed inside the lead probe to the desired sampling depth (5 feet below the watertable). The probe casing was retracted from around the screen, exposing the screen in the aquifer. Water samples were then collected from the probe in accordance with the approved SOP.

Field GC Analysis

The approved SOP for the Upper Aquifer Investigation required that upper aquifer samples be analyzed for the compounds: benzene, ethylbenzene, toluene, xylene, chlorobenzene, 1,2-dichloroethene (1,2-DCE), and 1,1-dichloroethane (1,1-DCA). The following were also included in the analysis for the upper aquifer investigation:

- 1,1-dichloroethene (1,1-DCE), 1,1,1-trichloroethane (1,1,1-TCA), trichloroethene (TCE), tetrachloroethene (PCE), acetone, methyl isobutyl ketone (MIBK), methyl ethyl ketone, carbon tetrachloride, and styrene.

These compounds were added to the analyte list since the GC was already calibrated to analyze for these analytes for the Lower Aquifer Investigation.

Data Limitations

The upper aquifer geoprobe sampling and analysis investigation is a screening tool, which can be used to aid in the placement of monitoring wells. The screening method derives data that is semi-quantitative in nature, to be used as an indicator of the extent of contamination.

In samples with high concentrations of acetone (i.e., GP58), sample quantitation limits were raised above 5 ug/l, possibly resulting in underreporting of other low concentration VOCs that might be present below the raised quantitation limit. However, as a conservative approach, all sample locations with high acetone concentrations and elevated quantitation limits were located on the contaminated side of the "zero" line. For instance, GP58 had no reportable benzene contamination and a sample quantitation limit of 100 ug/L, but the "zero" line was drawn between GP58 and GP 61, where no detectable VOC concentrations were found at a quantitation limit of 5 ug/L.

RESULTS AND CONCLUSIONS

Table 1 presents the location coordinates and sampling depths of the upper aquifer groundwater samples. Field analytical results for benzene, acetone, BETX and total VOCs are presented in Table 2. Because benzene and acetone were most frequently detected in shallow groundwater at the site, concentrations of benzene and acetone are also plotted on Figures 3 and 4, respectively. Figure 5 shows the plot of total VOC concentrations detected at the sampling points (total VOCs corresponds to the sum total of target VOCs detected with the field GC). Field GC analytical reports for the target compounds in all samples are tabulated in Appendix A. Data quality associated with the Upper Aquifer Investigation was in accordance with the approved SOW and SOP and in accordance with the draft Quality Assurance Project Plan (QAPP) and U.S. EPA comments regarding the QAPP discussion of the analytical results and conclusions associated with the Upper Aquifer Investigation is presented according to applicable area of the Site (i.e., A, B, C, or D).

Area A - Wetland Area West of the ACS Facility

Results

VOCs, primarily benzene and acetone, were detected in the wetland area west of the ACS facility. Figures 3 and 4 show the concentrations of benzene and acetone detected in the area, respectively. Acetone was the most prevalent VOC detected in Area A found in 11 samples (Figure 4). The highest level of acetone was found in GP58 where acetone was detected at an estimated concentration of 50,600 ug/L. However, at a distance of approximately 100 feet west and southwest of this location, acetone was not detected above quantitation limits. South of GP58 and GP60, acetone was detected at significantly lower concentrations (Figure 4).

Benzene was only detected in three samples in the wetland, GP53, GP55, and GP57, at concentrations of 550 ug/L, 5000 ug/L and 400 ug/L, respectively. Other VOCs detected in groundwater samples collected from GP53 and GP55 include cis- and trans-1,2-DCE and toluene (Appendix A).

A comparison of the eight deeper groundwater samples collected adjacent to shallow samples is shown in Table 3. At GP57, both benzene and acetone were detected at higher concentrations in the 10 foot deep sample compared to five foot deep sample. At the other nested sample locations, acetone was the only VOC detected in samples (GP50, GP68) and was found at slightly higher concentrations in the deep samples. No VOCs were detected in either the shallow or the deeper samples collected at GP51, GP52, GP66, GP70 and GP71. These findings indicate that VOC contamination does extend below the upper five feet of the upper aquifer and that, the concentrations are higher near the bottom of the upper aquifer at several locations.

Conclusions

The approximate extent of contamination in the upper aquifer has been defined in the wetland area west of the ACS facility. A line of "zero" VOC concentrations ("zero" is defined as concentrations of VOCs below detection limits) was established in the upper aquifer by samples (from north to south) GP62, GP61, GP66, GP52, GP71, GP51 and GP70. This is consistent with Objective #1 established for the Area A investigation.

The line of "zero" contamination forms a sharp boundary which coincides with the border between the wetland area to the west and dry land to the east. In the area near GP57, benzene concentrations sharply decreased from 5000 ug/L at GP57 to less than detection limits at GP58 located approximately 100 feet west. Other areas exhibit a similar abrupt decrease in contaminant concentration over a relatively small distance. This sharp boundary is unlike other areas of the site which typically exhibit groundwater contamination as a gradational zone. The sharp contrast between contaminated and non-contaminated groundwater in Area A is likely due to the wetland area acting as a discharge boundary for the upper aquifer groundwater flow system. Where there is standing water, there will be essentially no horizontal gradient and therefore, no driving force to push the benzene contaminated water further out into the wetland.

Area B - East of Colfax, South of Reder Road

Results

VOCs were detected in many of the groundwater samples collected in Area B (Table 2). Figures 3 and 4 show the concentrations of benzene and acetone, respectively, detected in the area. The highest VOC concentrations were found in GP90, located northeast of the intersection of Colfax and Reder Roads, where cis-1,2-DCE, total BETX, and MIBK were detected at 25,700 ug/L, 52,720 ug/L and 8,960 ug/L, respectively. Other high VOC concentrations were found in groundwater samples collected just north of the UST located at the City of Griffith landfill and south of the intersection of Colfax and Reder Roads. Benzene was detected as high as 6,950 ug/L at GP124 and was also found at elevated

concentrations south of Reder Road (4,580 ug/L in GP121, and 3,430 ug/L in GP82). Acetone was detected near the UST, ranging in concentration from 3,900 ug/L in GP87 to 6,000 ug/L in GP123, and south of Reder Road at concentrations ranging from 834 ug/L in GP122 to 4,780 ug/L in GP121 (Figure 4). Other VOCs detected in the area include 1,2-dichloroethane, 1,1,1-TCA, toluene, ethylbenzene, xylenes and styrene (Appendix A).

South of the intersection of Colfax and Reder Roads, the highest concentrations of VOCs, primarily benzene, acetone, ethylbenzene and xylene, were detected at GP116, GP120, GP128 and GP134. These sampling locations are generally located in a north-south line approximately 600 to 700 feet east of Colfax Road (see Figure 2). East and west of this line, VOCs were either generally not detected or found at concentrations significantly less than the central line. VOCs were not found in GP84, GP85, GP86, and GP132 to the east of this line, whereas to the west, VOCs were not detected in GP118, GP129, GP135 and GP145 (Table 2).

Benzene concentrations in the central plume decreased from GP82 (3,430 ug/L) to the north to GP120 (131 ug/L), then increased again to the south from GP120 (131 ug/L) to GP128 (506 ug/L) to GP134 (1100 ug/L). South of GP134, benzene concentrations decreased again at GP143, GP144 and GP156 (Figure 3). The southern and southeastern extent of benzene contamination in the upper aquifer was delineated by groundwater samples collected at GP151 to GP155 and GP158 and GP159. Benzene was not detected at sample locations GP135 and GP145 located further to the west.

Acetone concentrations generally decreased with distance to the south from the site (Figure 4). The southernmost detection of acetone occurred at GP156, located approximately 1600 feet southeast of the intersection of Colfax and Reder roads, where acetone was detected at 34 ug/L. Acetone was not detected in GP118, GP129 GP144, and GP155 to the west, GP159 and GP158 to the southeast, and GP85, GP132, GP151, and GP152 and to the east. Two isolated detections of acetone occurred at GP153 and GP157 where acetone was found at 15 ug/L and 38 ug/L, respectively.

Conclusions

There are several potential sources of elevated BETX concentrations upgradient of monitoring well MW6, near the intersection of Colfax and Reder Roads. Possible sources include the Off-Site Containment area and the area designated as the Kapica-Pazmey area in the RI. It appears that there is a zone of VOC contamination in the upper aquifer extending from the Kapica-Pazmey area, south from monitoring well MW-6 to MW-19 and beyond.

The approximate extent of VOC contamination in the upper aquifer south of Reder Road was defined during the investigation. A line of "zero" VOC detections can be established in the upper aquifer by samples which surround the plume of benzene and acetone to the west, south and east. This is consistent with Objective #1 established for the Area B investigation. With respect to Objectives 2 and 3, the industrial facilities to the north and the UST area in the Griffith town yard do not appear to represent major contributors to the VOC plume.

Area C - Southwest of Griffith Landfill

Results

Acetone was the only VOC detected in Area C at three sampling locations. The acetone concentrations range from 34 ug/L in GP73 to 57 ug/L in GP74. Concentrations of acetone detected in GP73 and GP74 were not detected in groundwater samples collected 200 feet southwest (Figure 4).

Conclusions

Acetone was the only VOC sporadically detected in this area at concentrations less than 57 ug/L. Acetone was selected as a contaminant of concern for the ACS Site in the Record of Decision (ROD). However, when comparing the concentration of acetone detected at GP74 (57 ug/L) to the "Final Remediation Level" for acetone in the ROD (192 ug/L), the detected concentrations of acetone in Area C are well below these levels.

Area D - North and East Perimeter

Results

East of Colfax Road, VOCs were detected in groundwater samples collected from GP91, GP92, GP93 and GP94. At GP91, located 200 feet north of GP90, total VOC concentrations were 16.2 ug/L and at GP101 located approximately 400 feet east, VOCs were not detected.

VOCs were detected above quantitation limits in only one of the upper aquifer groundwater samples collected east of the north-south line of points defined by GP90 to GP93. The VOC, 1,2-DCA, was detected at a concentration of 10 ug/L in GP94 (Appendix A).

North of the ACS site in Area D, VOCs were detected in samples GP104 through GP108, GP112, GP114, GP139 and GP140 (Table 2). The highest VOC concentrations were detected in samples GP105 and GP107, where total VOCs were 327 ug/L and 6,213 ug/L, respectively (Table 2). These samples contained several VOC constituents, including acetone, benzene, 1,1-DCA, cis-1,2-DCE, and MIBK above the quantitation limit. The distribution of benzene and acetone in the north perimeter area is presented in Figures 3 and 4, respectively. Benzene was detected only in GP105, GP106 and GP107, whereas acetone was detected in samples collected throughout the area (Figure 4). In samples GP139 and GP140, acetone was the only compound detected in the groundwater samples.

Conclusions

The approximate extent of impacted groundwater has been defined along the east perimeter of the ACS site by the Upper Aquifer Investigation. The absence of VOC detections in samples GP95 through GP101 indicates that VOCs have not migrated beyond 300 feet east of Colfax Road. This is consistent with both the results of previous investigations and the upper aquifer groundwater flow system in the area (Objective #1). Groundwater flow in a

northerly direction on the east perimeter of the ACS site appears to provide a hydraulic barrier to eastward migration of VOCs (Figure 1).

The approximate extent of benzene contamination north of the ACS site is defined by groundwater samples from locations GP108, GP139 to GP140, GP113 and GP104 (Figure 3). With exceptions of the detection of acetone in several samples and MIBK detected in GP108, the extent of the benzene plume also corresponds to the outer limits of VOC contamination (Objective #2). The extent of acetone detections was not defined to a "zero" line north of samples GP139 and GP140 in the perimeter area. The low level detections of acetone appear to decrease to the north onto LaSalle Steel property. (Monitoring wells planned for this area will provide further data for the final clarification of the acetone anomaly.)

RECOMMENDATIONS

Based on the results and conclusions of the Upper Aquifer Investigation, the overall objective of the investigation, to delineate the extent of upper aquifer contamination sufficiently to locate the placement of additional monitoring wells, has been satisfied around the site.

The following actions are proposed to complete the delineation of upper aquifer VOC contamination.

Area A - The approximate extent of VOC contamination has been defined by a series of closely spaced (100 foot) sampling locations. The sampling showed a clear delineation between the zones of contamination and non-contamination. VOC contamination does not extend westward, beyond the edge of the wetland. Because of the clear delineation of VOC contamination, and the difficulties inherent in constructing monitoring wells within the wetlands, no additional monitoring wells are warranted in this area. However, in a letter dated April 29, 1996, U.S.EPA is requiring that one monitoring be installed in Area A at the location labeled as J on Figure 6. A copy of the U.S. EPA letter is attached as Appendix D.

Also, as required in the April 29, 1996 letter, U.S.EPA is requiring that seven to eight piezometers be installed at four locations as piezometer nests in Area A. Each piezometer nest would consist of two piezometers each. One piezometer would be installed at the base of the upper aquifer and a second would be installed at the water table surface. If appropriate, existing piezometer P-23 may be used as one piezometer as one location. The piezometer nest locations, N-1, N-2, N-3 and N-4, are shown on Figure 6.

Area B - Four monitoring wells are proposed to supplement existing well MW-19 in defining the limits of VOC contamination in this area. The preliminary

locations of the four wells, labeled E, F, G, and H, are shown on Figure 6. The wells will be installed in close proximity to the location where shallow groundwater samples were collected at GP135, GP159, GP151 and GP155. These locations have been selected to surround the VOC plume and provide an indication of whether the extent of contamination is remaining constant or expanding. Final locations will be selected in the field, based on accessibility, with concurrence from the U.S. EPA, its field oversight subcontractor and IDEM.

Monitoring well, I, will be located in the central portion of the plume to monitor the nature of contamination within the plume. This well will be located near GP134 where elevated concentrations of benzene were detected.

In a letter dated April 29, 1996, U.S. EPA is requiring one additional monitoring well in Area B (Appendix D). This monitoring well is labeled as K on Figure 6.

The actual locations of all Area B wells will be selected in the field, based on accessibility, with concurrence from the U.S. EPA, its field oversight subcontractor and IDEM.

Area C - No monitoring wells are proposed for the southwest side of the landfill. Acetone was the only VOC sporadically detected in this area at concentrations less than 57 ug/L. This concentration is significantly less than the "Final Remediation Level" listed in the ROD for acetone which is 192 ug/L. Two existing monitoring wells located in Area C (M-1S, MW15; Figure 1) will continue to serve as sentinel wells for monitoring potential contaminant migration southwest of the landfill area should such monitoring become appropriate.

Area D - Four additional monitoring wells screened in the upper aquifer are proposed along the north and east sides of the site. The locations, labeled A, B, C, and D on Figure 6, have been selected at the boundaries of the VOC plume in this area. The proposed wells will act as sentinel wells, providing an indication whether the extent of contamination is remaining constant or expanding.

In a letter dated April 29, 1996, U.S. EPA is requiring two additional monitoring wells in Area D (Appendix D). The locations of these wells, labeled as L and M, are shown on Figure 6.

Final locations of Area D monitoring wells will be selected in the field, based on accessibility, with concurrence from the U.S. EPA, its field oversight subcontractor and IDEM.

UPPER AQUIFER INVESTIGATION SOPs

Additional predesign investigation of the upper aquifer will include installation, development and sampling of upper aquifer monitoring wells, and sampling of residential wells (see below). SOPs developed for performing these tasks are included in Appendix C. The analytical parameters for the proposed upper aquifer sampling are summarized in Table 4. The parameter list will include PCBs and data interpretation will evaluate the potential for facilitated transport of PCBs by volatile organic compounds.

RESIDENTIAL WELL IDENTIFICATION AND SAMPLING

Due to the dimensions of the VOC plume east of Colfax and south of Reder Road, locations of residential wells in this area were identified which may be potentially susceptible to VOC migration along the well casing from the upper aquifer to the lower aquifer (lower aquifer is the formation in which the residential wells are screened). Four residential wells have been identified in the area and are listed below:

- 1002 Reder Road
- 430 East Avenue H
- 940 Arbogast
- 938 Arbogast

In the first draft of the Upper Aquifer Technical Memorandum, the last listed residence was mis-identified as 950 Arbogast. A field check indicated that the correct address is 938 Arbogast. The locations of the properties are shown on Figure 6. A search for well logs for each of these residences was conducted. The Department of Natural Resources was not able to produce well logs for the identified wells and so none can be provided.

It is recommended that water samples be collected from these four residential to coincide with the collection of groundwater samples from the new monitoring wells proposed in this Technical Memorandum. Water samples from these four wells will be analyzed for full scan TCL/TAL list. An analytical summary is presented in Table 4.

The locations of other private wells located in the vicinity of the upper aquifer VOC plume southeast of the ACS Site are presented in the May 1996 Lower Aquifer Investigation report. Surrounding well locations are plotted on Figure 8 of the Lower Aquifer Technical Memorandum and a summary of updated private well information is presented in Table 11 of the Lower Aquifer Technical Memorandum.

Future residential well sampling will be re-evaluated on the basis of the private well sampling results and after review of the well inventory contained in the Lower Aquifer Technical Memorandum.

SURFACE WATER SAMPLE

One surface water sample was collected near P63, north of the ACS facility. The location of the surface water sample is shown on Figure 5. The sample was taken from standing surface water adjacent to a ditch that flows beneath the railroad tracks from properties north of the site (i.e., LaSalle Steel) towards the wetland area (Area A). The water sample was analyzed with the field GC and found to contain benzene at 1,100 ug/L. No other VOCs were detected in the water sample.

Both a surface water and a sediment sample were collected at the location of this seep during the Wetland Investigation conducted during May 1996. The surface water sample was designated as sample SW9 and the sediment sample was designated as SD28. The surface water sample was found to contain benzene at 1,800 ug/L and chloroethane at 440 ug/L. Trace levels of several semivolatile compounds were detected, at below the method quantitation limit. Sediment sample SD38 was found to contain 11,000 ug/kg of benzene, 5,650 ug/kg total SVOCs, and 229 ug/kg total PCBs. For further details, laboratory reporting sheets, and decisions regarding the ditch, refer to the Wetland Investigation Technical Memorandum, dated July 25, 1996.

ACS PRODUCTION WELLS

The abandonment of the ACS production wells is discussed in the Lower Aquifer Technical Memorandum.

Attachments:

- Table 1. Summary of Sampling Coordinates and Depths
- Table 2. Tabulation of Selected VOC Detections
- Table 3. Comparison of Shallow and Deep Groundwater Samples in the Upper Aquifer
- Table 4. Summary of Monitoring Well Analytical Parameters

- Figure 1. Upper Aquifer Sampling Areas
- Figure 2. Upper Aquifer Sampling Points
- Figure 3. Upper Aquifer Plot of Benzene Detections (ug/L)
- Figure 4. Upper Aquifer Plot of Acetone Detections (ug/L)
- Figure 5. Total VOC Concentrations in Upper Aquifer (ug/L)
- Figure 6. Location of Proposed Monitoring Wells and Residential Well Sampling

- Appendix A. Tabulation of VOC Analyses with Field GC
- Appendix B. Field GC Printouts and Plots (available upon request)
- Appendix C. Upper Aquifer Investigation SOPs
- Appendix D. April 29, 1996 letter from U.S. EPA

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Table 1. Summary of Sample Coordinates and Depths
ACS NPL Site

Probe No.	East feet	North feet	Approx. G.W. Level feet	Approx. Sample Depth feet
GP50	4756.5	7309.0	3.0	8.0
GP-50A	4756.5	7309.0	3.0	12.0
GP51	4568.2	7240.7	1.5	6.5
GP-51A	4568.2	7240.7	1.5	8.5
GP52	4813.6	7857.5	0.5	5.5
GP52A	4687.4	7519.2	0.5	10.5
GP53	5042.0	7618.2	1.5	6.5
GP55	5026.8	7451.6	1.0	6.0
GP56	4994.1	7750.3	1.0	6.0
GP57	4938.8	7658.5	1.5	6.5
GP57A	4938.8	7658.5	1.5	11.5
GP58	4829.8	7705.0	1.0	6.0
GP59	4751.7	7615.9	1.0	6.0
GP60	4830.7	7537.2	1.5	6.5
GP61	4741.4	7752.7	1.0	6.0
GP62	4687.4	7519.2	1.5	6.5
GP63	4855.1	7259.5	1.5	6.5
GP64	4798.0	7166.3	1.0	6.0
GP65	4763.6	7087.3	1.0	6.0
GP66	4716.0	7632.5	1.0	6.0
GP66A	4716.0	7632.5	1.0	11.0
GP67	4723.3	7432.8	1.0	6.0
GP68	4731.6	7032.7	2.5	7.5
GP68A	4731.6	7032.7	2.5	12.5
GP69	4747.1	7168.2	2.0	7.0
GP70	4616.5	7064.6	1.5	6.5
GP70A	4616.5	7064.6	0.0	10.0
GP71	4628.8	7420.4	0.5	5.5
GP71A	4628.8	7420.4	0.0	10.0
GP72	5472.9	5563.3	ns	ns
GP73	4797.3	4726.1	5.0	11.0
GP74	4698.9	4904.4	4.5	11.0
GP75	4606.8	5082.5	5.5	11.0

Table 1. Summary of Sample Coordinates and Depths
ACS NPL Site

Probe No.	East feet	North feet	Approx. G.W. Level feet	Approx. Sample Depth feet
GP76	4509.4	5257.8	5.0	10.0
GP77	4395.7	5420.9	4.5	10.5
GP78	4305.3	5619.1	5.0	10.0
GP79	4212.7	5795.8	5.0	10.0
GP80	5472.9	5563.3	19.0	24.0
GP81	5622.8	5547.8	15.0	20.0
GP82	5621.1	5352.5	9.0	14.0
GP83	5822.3	5356.9	9.0	14.0
GP84	5797.9	5171.7	9.0	14.0
GP85	5806.4	4972.5	5.0	10.0
GP86	5976.4	5043.0	6.0	11.0
GP87	5111.6	5523.4	10.0	15.0
GP88	5160.6	5368.9	13.0	18.0
GP89	5118.5	5565.8	21.0	26.0
GP90	5538.8	5705.9	19.0	24.0
GP91	5610.7	5891.5	17.0	21.0
GP92	5725.9	6086.7	13.0	18.0
GP93	5802.3	6267.1	11.0	16.0
GP94	6149.4	6280.2	10.0	15.0
GP95	6230.7	6472.2	4.0	9.0
GP96	6298.7	6648.4	4.0	9.0
GP97	6295.1	6832.1	4.0	9.0
GP98	6350.2	7046.3	4.0	9.0
GP99	6410.4	7280.7	6.0	11.0
GP100	6405.0	7678.9	6.0	11.0
GP101	5944.6	5706.5	10.0	15.0
GP102	5994.6	5905.4	10.0	15.0
GP103	6062.3	6086.4	3.0	8.0
GP104	6217.2	7736.6	3.0	8.0
GP105	6002.5	7753.3	4.0	9.0
GP106	5818.0	7827.9	3.0	8.0
GP107	5581.7	7906.7	2.0	7.0
GP108	5398.0	7984.1	2.0	7.0
GP109	5195.9	7973.0	3.0	8.0

Table 1. Summary of Sample Coordinates and Depths
ACS NPL Site

Probe No.	East feet	North feet	Approx. G.W. Level feet	Approx. Sample Depth feet
GP110	4949.6	8072.4	4.0	9.0
GP111	6368.8	7845.2	5.0	10.0
GP112	6138.2	7961.0	3.0	8.0
GP113	5985.9	7954.8	4.0	9.0
GP114	5794.2	8025.5	4.0	9.0
GP115	4592.5	6905.3	6.0	11.0
GP116	5651.9	4835.4	5.0	10.0
GP117	5435.5	4793.5	2.0	7.0
GP118	5084.4	4798.9	4.0	9.0
GP119	5777.1	4741.2	5.0	9.0
GP120	5594.5	4625.2	1.5	6.5
GP121	5393.1	5512.7	21.0	26.0
GP122	5305.8	5361.2	15.0	20.0
GP123	5114.8	5612.9	21.0	26.0
GP124	5231.1	5606.3	22.0	27.0
GP125	6234.4	7399.7	10.0	15.0
GP126	5889.3	4782.9	3.0	8.0
GP127	5816.6	4591.6	4.0	9.0
GP128	5587.7	4518.1	3.0	8.0
GP129	5392.9	4629.7	3.0	8.0
GP130	5275.9	4790.1	4.0	9.0
GP131	6088.4	4830.5	ns	ns
GP132	6056.7	4630.5	4.0	9.0
GP133	5929.2	4450.4	5.0	10.0
GP134	5737.9	4367.5	4.0	9.0
GP135	5489.0	4348.2	7.0	12.0
GP136	5398.1	4501.4	3.0	8.0
GP137	6252.8	8061.6	4.5	9.5
GP138	6039.3	8131.7	3.0	8.0
GP139	5877.2	8195.5	4.0	9.0
GP140	5650.8	8208.5	5.0	10.0
GP141	5458.5	8139.6	4.0	9.0
GP142	5229.5	8092.5	6.0	11.0
GP143	5923.7	4120.5	5.0	10.0

Table 1. Summary of Sample Coordinates and Depths
ACS NPL Site

Probe No.	East feet	North feet	Approx. G.W. Level feet	Approx. Sample Depth feet
GP144	5735.3	4126.4	4.0	9.0
GP145	5545.9	4217.0	5.0	12.0
GP146	5728.0	3713.4	4.0	9.0
GP147	5737.9	3303.0	ns	ns
GP148	4571.6	4681.2	9.0	14.0
GP149	4495.9	4858.4	6.0	11.0
GP150	4971.8	4804.2	4.0	9.0
GP151	6125.5	4434.9	4.0	9.0
GP152	6186.9	4209.7	4.0	9.0
GP153	5616.1	4023.2	1.0	6.0
GP154	5696.9	3863.9	2.0	7.0
GP155	5907.7	3879.7	2.5	7.5
GP156	6077.8	4003.6	2.0	7.0
GP157	5511.0	3980.2	1.0	6.0
GP158	6296.3	3994.5	3.0	8.0
GP159	6147.1	3809.8	2.0	7.0
GP160	5511.0	3877.1	1.0	6.0
GP161	5413.9	4054.1	0.5	5.5

notes:

1. ns - no sample collected
2. No sample collected from GP72. Sample obtained from same location later and renamed GP80.
3. Sample collected from GP54 was not analyzed due to high concentrations. Location of GP54 was not surveyed.

Table 2. Tabulation of Selected VOC Detections (revised)
Upper Aquifer Investigation, ACS NPL Site

Probe Number	Coordinates		Acetone (ug/L)	Benzene (ug/L)	BETX (ug/L)	Total VOCs (ug/L)
	Easting	Northing				
GP50	4756.5	7309.0	19	nd	nd	19
GP51	4568.2	7240.7	nd	nd	nd	nd
GP52	4813.6	7857.5	nd	nd	nd	nd
GP53	5042.0	7618.2	210	550	573	813
GP55	5026.8	7451.6	15	400	400	420
GP56	4994.1	7750.3	6,700	nd	nd	6,700
GP57	4938.8	7658.5	770	5,000	5,000	5,770
GP58	4829.8	7705.0	50,600	nd	nd	50,600
GP59	4751.7	7615.9	11	nd	nd	11
GP60	4830.7	7537.2	3,560	nd	nd	3,560
GP61	4741.4	7752.7	nd	nd	nd	nd
GP62	4687.4	7519.2	nd	nd	nd	nd
GP63	4855.1	7259.5	nd	nd	nd	nd
GP64	4798.0	7166.3	12	nd	nd	12
GP65	4763.6	7087.3	nd	nd	nd	nd
GP66	4716.0	7632.5	nd	nd	nd	nd
GP67	4723.3	7432.8	715	nd	nd	715
GP68	4731.6	7032.7	17	nd	nd	17
GP69	4747.1	7168.2	nd	nd	nd	nd
GP70	4616.5	7064.6	nd	nd	nd	nd
GP71	4628.8	7420.4	nd	nd	nd	nd
GP72	5474.1	5558.7	ns	ns	ns	ns
GP73	4797.3	4726.1	34	nd	nd	34
GP74	4698.9	4904.4	57	nd	nd	57
GP75	4606.8	5082.5	nd	nd	nd	nd
GP76	4509.4	5257.8	nd	nd	nd	nd
GP77	4395.7	5420.9	nd	nd	nd	nd
GP78	4305.3	5619.1	31	nd	nd	31
GP79	4212.7	5795.8	nd	nd	nd	nd
GP80	5472.9	5563.3	nd	7,860	22,803	23,120
GP81	5622.8	5547.8	1,720	nd	13,868	18,803
GP82	5621.1	5352.5	4,450	3,430	21,550	29,460
GP83	5822.3	5356.9	nd	nd	17	17
GP84	5797.9	5171.7	nd	nd	nd	nd
GP85	5806.4	4972.5	nd	nd	nd	nd
GP86	5976.4	5043.0	nd	nd	nd	nd
GP87	5111.6	5523.4	3,900	410	660	4,560
GP88	5160.6	5368.9	159	nd	nd	159
GP89	5118.5	5565.8	2,910	1,060	6,560	9,470
GP90	5538.8	5705.9	3,960	8,260	52,720	93,010
GP91	5610.7	5891.5	nd	nd	6	16

Table 2. Tabulation of Selected VOC Detections (revised)
Upper Aquifer Investigation, ACS NPL Site

Probe Number	Coordinates		Acetone (ug/L)	Benzene (ug/L)	BETX (ug/L)	Total VOCs (ug/L)
	Easting	Northing				
GP92	5725.9	6086.7	82	nd	nd	82
GP93	5802.3	6267.1	43	5	5	53
GP94	6149.4	6280.2	nd	nd	nd	10
GP95	6230.7	6472.2	nd	nd	nd	nd
GP96	6298.7	6648.4	nd	nd	nd	nd
GP97	6295.1	6832.1	nd	nd	nd	nd
GP98	6350.2	7046.3	nd	nd	nd	nd
GP99	6410.4	7280.7	nd	nd	nd	nd
GP100	6405.0	7678.9	nd	nd	nd	nd
GP101	5944.6	5706.5	nd	nd	nd	nd
GP102	5994.6	5905.4	nd	nd	nd	nd
GP103	6062.3	6086.4	nd	nd	nd	nd
GP104	6217.2	7736.6	48	nd	nd	48
GP105	6002.5	7753.3	205	53	53	327
GP106	5818.0	7827.9	38	118	118	156
GP107	5581.7	7906.7	860	5,320	5,320	6,213
GP108	5398.0	7984.1	nd	nd	nd	6
GP109	5195.9	7973.0	nd	nd	nd	nd
GP110	4949.6	8072.4	nd	nd	nd	nd
GP111	6368.8	7845.2	nd	nd	nd	nd
GP112	6138.2	7961.0	172	nd	nd	172
GP113	5985.9	7954.8	nd	nd	nd	nd
GP114	5794.2	8025.5	53	nd	nd	53
GP115	4592.5	6905.3	nd	nd	nd	nd
GP116	5651.9	4835.4	240	710	5,926	6,216
GP117	5435.5	4793.5	175	nd	nd	175
GP118	5084.4	4798.9	nd	nd	nd	nd
GP119	5777.1	4741.2	17	5	5	32
GP120	5594.5	4625.2	719	131	376	1,095
GP121	5393.1	5512.7	4,780	4,580	11,840	16,620
GP122	5305.8	5361.2	834	nd	nd	834
GP123	5114.8	5612.9	6,000	1,590	3,680	18,600
GP124	5231.1	5606.3	3,810	6,950	6,950	10,760
GP125	6234.4	7399.7	nd	nd	nd	nd
GP126	5889.3	4782.9	51	nd	nd	67
GP127	5816.6	4591.6	13	nd	nd	19
GP128	5587.7	4518.1	nd	506	5,376	5,376
GP129	5392.9	4629.7	nd	nd	nd	nd
GP130	5275.9	4790.1	168	nd	nd	168
GP131	6088.4	4830.5	ns	ns	ns	ns
GP132	6056.7	4630.5	nd	nd	nd	nd
GP133	5929.2	4450.4	62	5	5	67

Table 2. Tabulation of Selected VOC Detections (revised)
Upper Aquifer Investigation, ACS NPL Site

Probe Number	Coordinates		Acetone (ug/L)	Benzene (ug/L)	BETX (ug/L)	Total VOCs (ug/L)
	Easting	Northing				
GP134	5737.9	4367.5	412	1,100	1,133	1,630
GP135	5489.0	4348.2	nd	nd	nd	nd
GP136	5398.1	4501.4	19	5	5	25
GP137	6252.8	8061.6	nd	nd	nd	nd
GP138	6039.3	8131.7	nd	nd	nd	nd
GP139	5877.2	8195.5	50	nd	nd	50
GP140	5650.8	8208.5	21	nd	nd	21
GP141	5458.5	8139.6	nd	nd	nd	nd
GP142	5229.5	8092.5	nd	nd	nd	nd
GP143	5923.7	4120.5	59	252	357	416
GP144	5735.3	4126.4	nd	172	172	172
GP145	5545.9	4217.0	nd	nd	nd	nd
GP146	5728.0	3713.4	nd	nd	nd	nd
GP147	5737.9	3303.0	ns	ns	ns	ns
GP148	4571.6	4681.2	nd	nd	nd	nd
GP149	4495.9	4858.4	nd	nd	nd	nd
GP150	4971.8	4804.2	nd	nd	nd	nd
GP151	6125.5	4434.9	nd	nd	nd	nd
GP152	6186.9	4209.7	nd	nd	nd	nd
GP153	5616.1	4023.2	15	nd	nd	15
GP154	5696.9	3863.9	nd	nd	nd	nd
GP155	5907.7	3879.7	nd	nd	nd	nd
GP156	6077.8	4003.6	34	39	39	73
GP157	5511.0	3980.2	38	nd	nd	38
GP158	6296.3	3994.5	nd	nd	nd	nd
GP159	6147.1	3809.8	nd	nd	nd	nd
GP160	5511.0	3877.1	nd	nd	nd	nd
GP161	5413.9	4054.1	nd	nd	nd	nd

notes:

1. nd - not detected
2. ns - no sample collected
3. total VOCs - sum total of target VOCs (Appendix A)

**Table 3. Comparison of Shallow and Deep Groundwater Samples in Upper Aquifer
ACS NPL Site**

Probe No.	Approx. Sample Depth (ft)	Concentration (ug/L)	
		Benzene	Acetone
GP-50	8.0	nd	19
GP-50A	12.0	nd	44
GP-51	6.5	nd	nd
GP-51A	8.5	nd	nd
GP-52	5.5	nd	nd
GP-52A	10.5	nd	nd
GP-57	6.5	5,000	770
GP-57A	11.5	44,700	1,400
GP-66	6.0	nd	nd
GP-66A	11.0	nd	nd
GP-68	7.5	nd	17
GP-68A	12.5	nd	348
GP-70	6.5	nd	nd
GP-70A	10.0	nd	nd
GP-71	5.5	nd	nd
GP-71A	10.0	nd	nd

Note: "A" designation indicates deep groundwater sample (i.e., 10 foot depth).

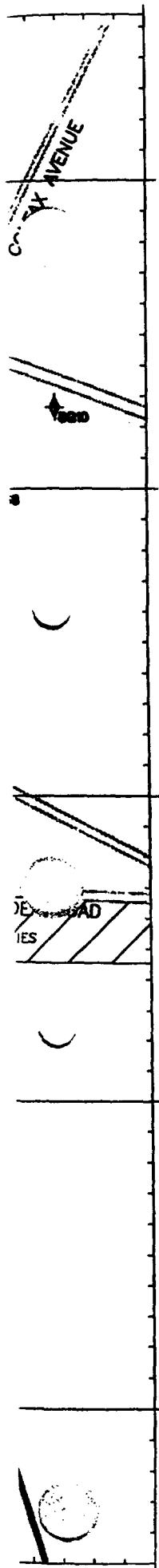
Table 4
Summary of Monitoring Well Analytical Parameters
American Chemical Service, Inc.
Griffith, Indiana

Well Number	TCL VOCs	Low Level TCL VOCs	TCL Semi- Volatile/PCBs	TAL Metals	
<u>Monitoring Wells</u>				<u>total</u>	<u>dissolved</u>
A	X		X	X	X
B	X		X	X	X
C	X		X	X	X
D	X		X	X	X
E	X		X	X	X
F	X		X	X	X
G	X		X	X	X
H	X		X	X	X
I	X		X	X	X
J	X		X	X	X
K	X		X	X	X
L	X		X	X	X
M	X		X	X	X
<u>Residential Wells</u>					
1002 Reder Road		X	X	X	X
430 East Avenue A		X	X	X	X
938 Arbogast		X	X	X	X
940 Arbogast		X	X	X	X

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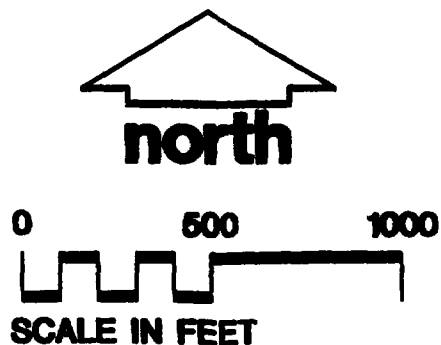


LEGEND

- A** LOCATION OF INVESTIGATION AREAS - SEE TEXT FOR FURTHER DESCRIPTION
- UPPER AQUIFER WELL LOCATION AND NUMBER**
- LEACHATE/UPPER AQUIFER WELL LOCATION AND NUMBER**
- PIEZOMETER LOCATION AND NUMBER**
- STAFF GAUGE LOCATION AND NUMBER**
- 626** **GROUNDWATER ELEVATION CONTOUR**
- FORMER UNDERGROUND STORAGE TANK LOCATION**

NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON OCTOBER 30, 1995.



7000

FIGURE 1

Developed By **PV** Drawn By **CCM**
 Approved By **QSV** Date **7/24/96**
 Reference
 Revisions **A** 7-23-96 Miscellaneous modifications.

UPPER AQUIFER SAMPLING AREAS

**UPPER AQUIFER INVESTIGATION
 AMERICAN CHEMICAL SERVICE, INC.
 NPL SITE
 GRIFFITH, INDIANA**

Drawing Number
4077.0072

**MONTGOMERY
 WATSON**



This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.

QUALITY CONTROL

Graphic Standards CCM
Lead Professional

3-13-95

Technical Review
Project Manager

Management Review
Other

8000

7000

6000

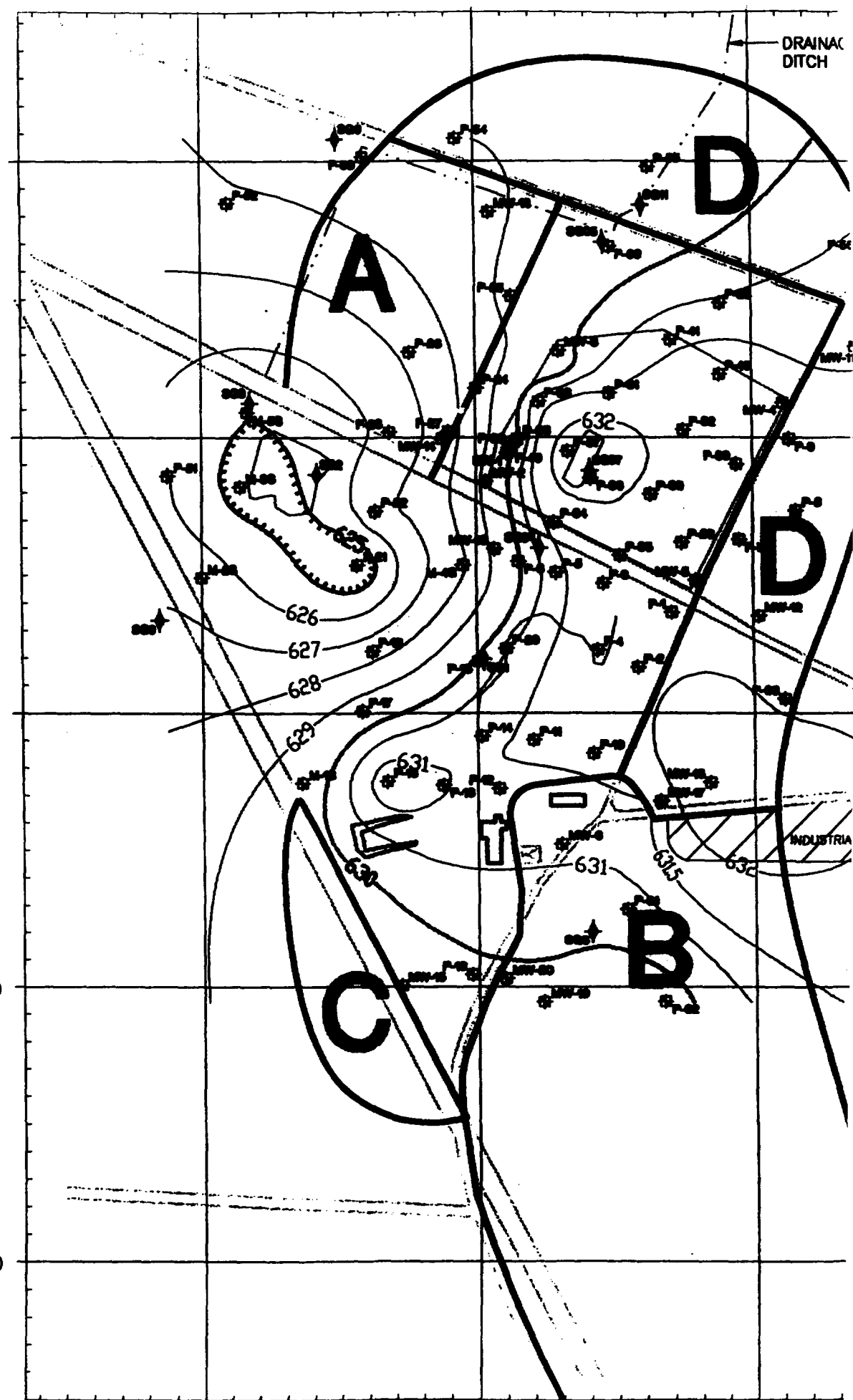
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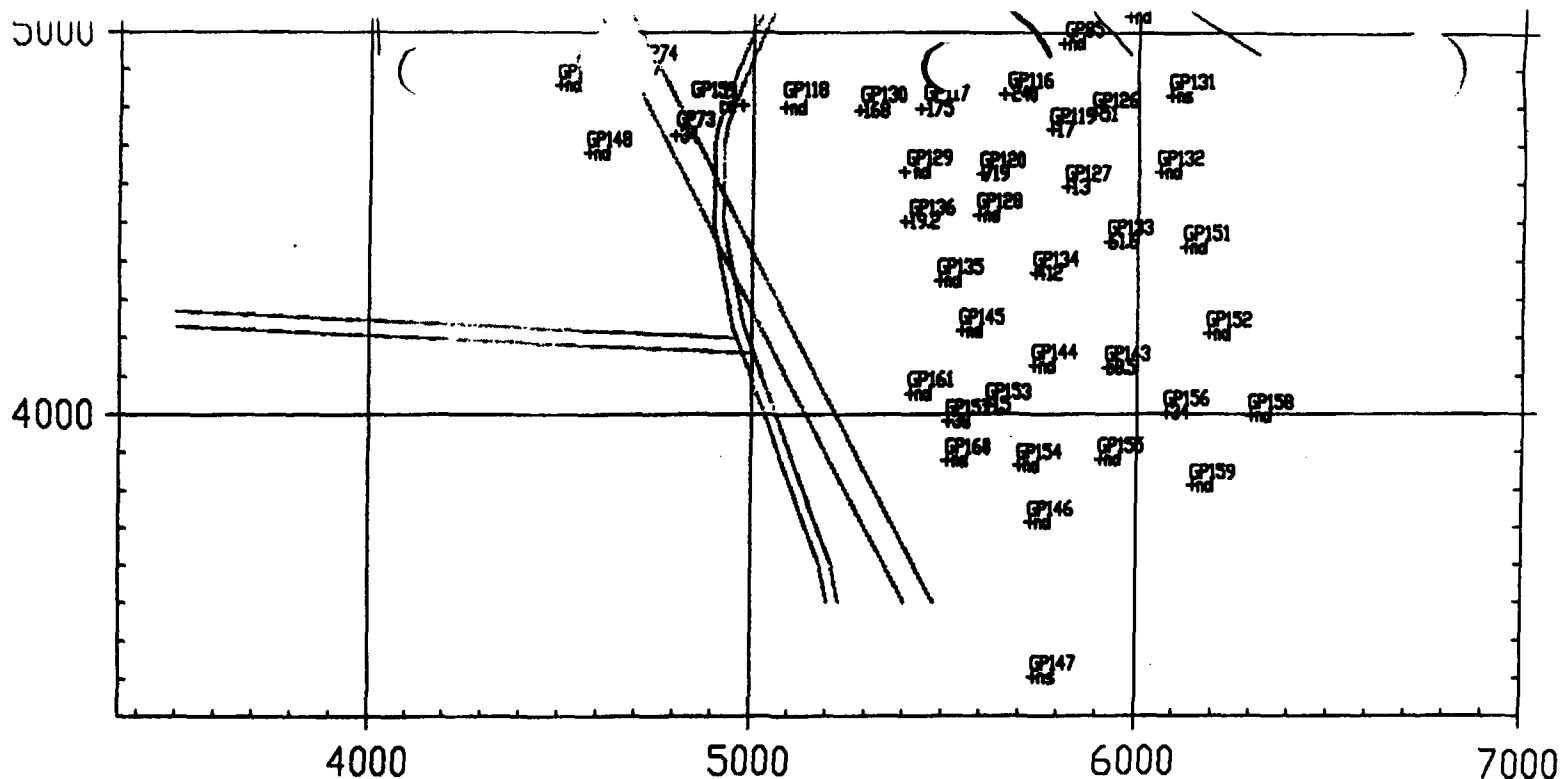
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LEGEND

- GP148 GROUNDWATER SAMPLING POINT
LOCATION AND NUMBER, WITH TOTAL
VOLATILE ORGANIC COMPOUNDS (ug/L)
- nd NOT DETECTED
- ns NOT SAMPLED
- na NOT ANALYZED
- FORMER UNDERGROUND STORAGE TANK LOCATION

NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON OCTOBER 30, 1995.
2. LOCATION FOR GP54 ESTIMATED - SAMPLING POINT NOT SURVEYED.

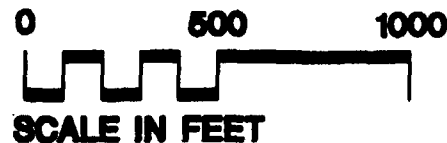
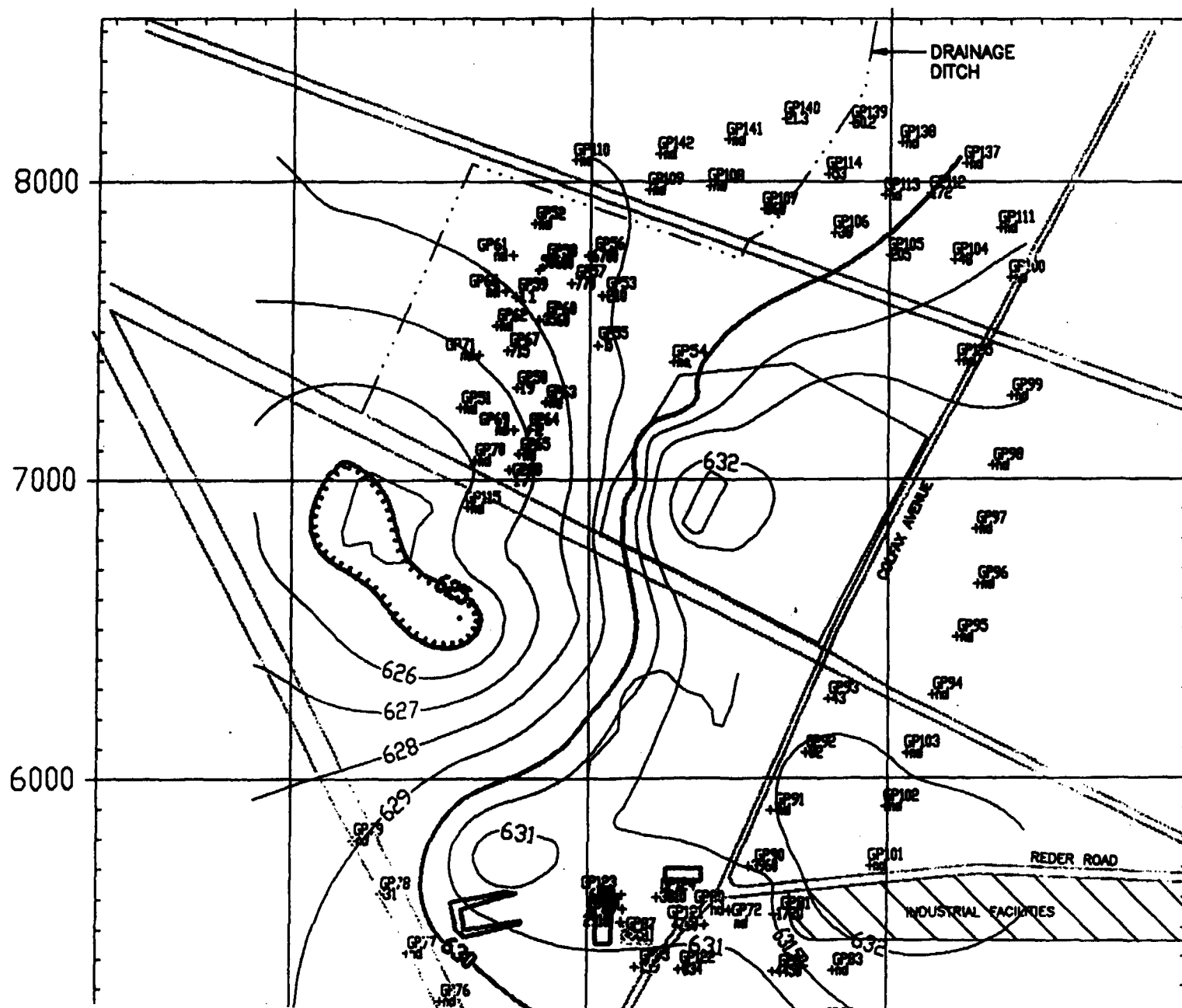


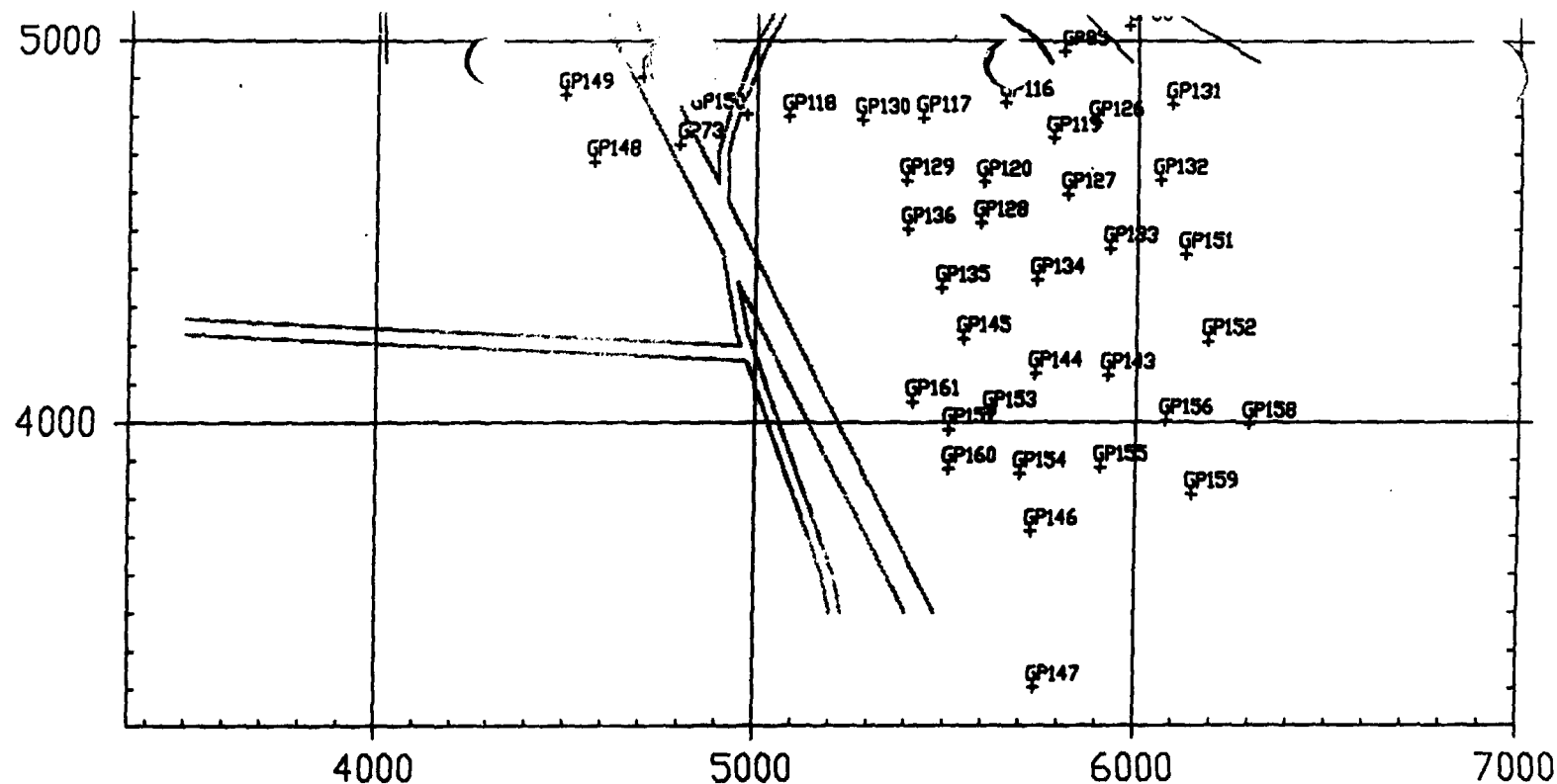
FIGURE 4

	Drawing Number 4077.0072	UPPER AQUIFER PLOT OF ACETONE DETECTIONS (ug/L)		Developed By PV	Drawn By CCM
		UPPER AQUIFER INVESTIGATION AMERICAN CHEMICAL SERVICE, INC. NPL SITE		Approved By PSV	Date 7/24/96
				Reference	
				Revisions	

This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.

QUALITY CONTROL	Graphic Standards CCM	3-13-86	Technical Review	Management Review
	Lead Professional		Project Manager	Other





LEGEND



GROUNDWATER SAMPLING POINT
LOCATION AND NUMBER



FORMER UNDERGROUND STORAGE TANK LOCATION



NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON OCTOBER 30, 1995.
2. LOCATION FOR GP54 ESTIMATED - SAMPLING POINT NOT SURVEYED.

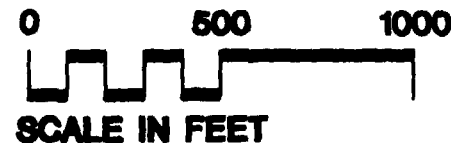


FIGURE 2



**MONTGOI
WAITS**

Drawing Number
4077.007

UPPER AQUIFER SAMPLING POINTS

UPPER AQUIFER INVESTIGATION
AMERICAL CHEMICAL SERVICE, INC.

Developed By PV

Drawn By CCM

Approved By *PSV*

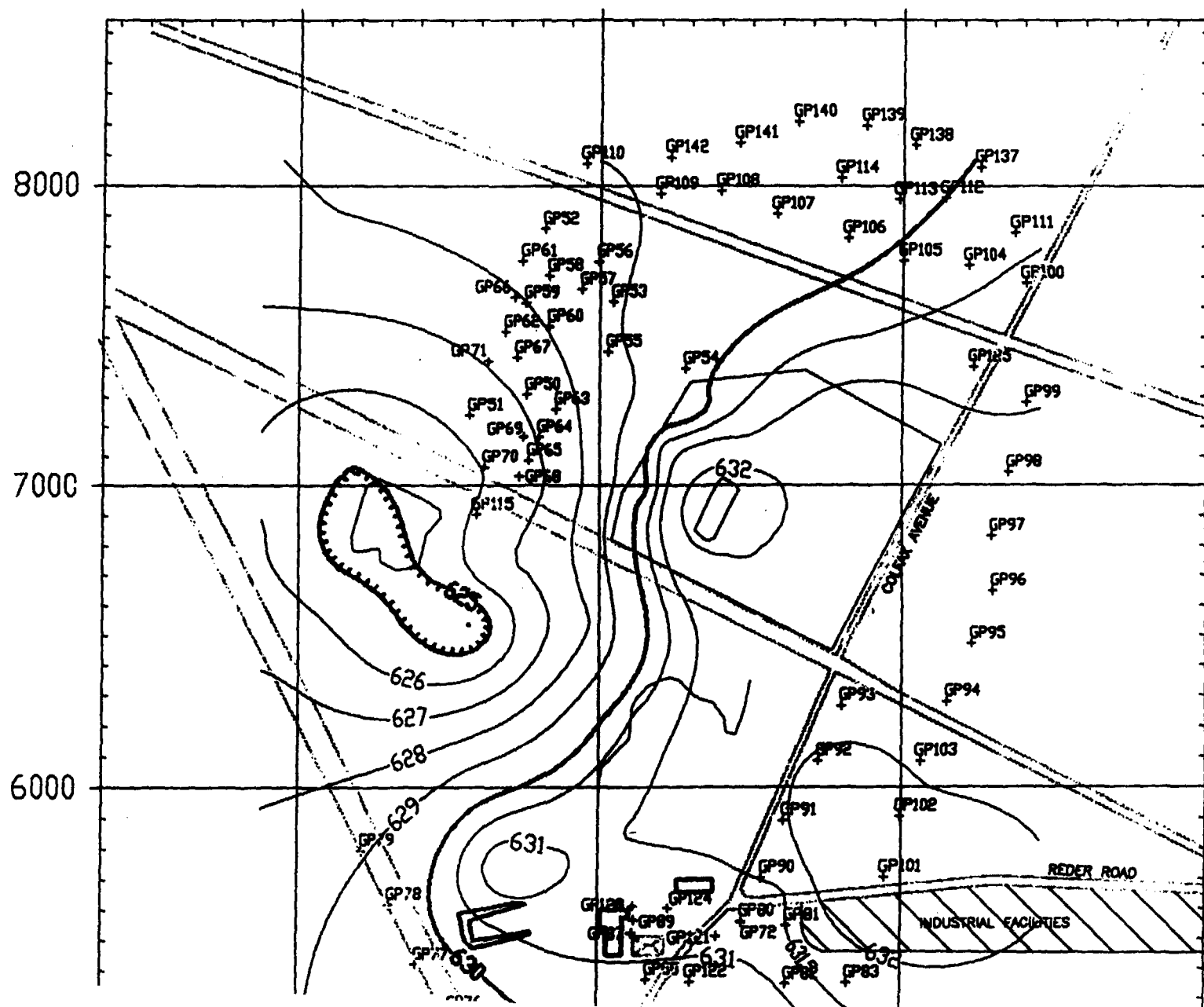
Date 7/24/96

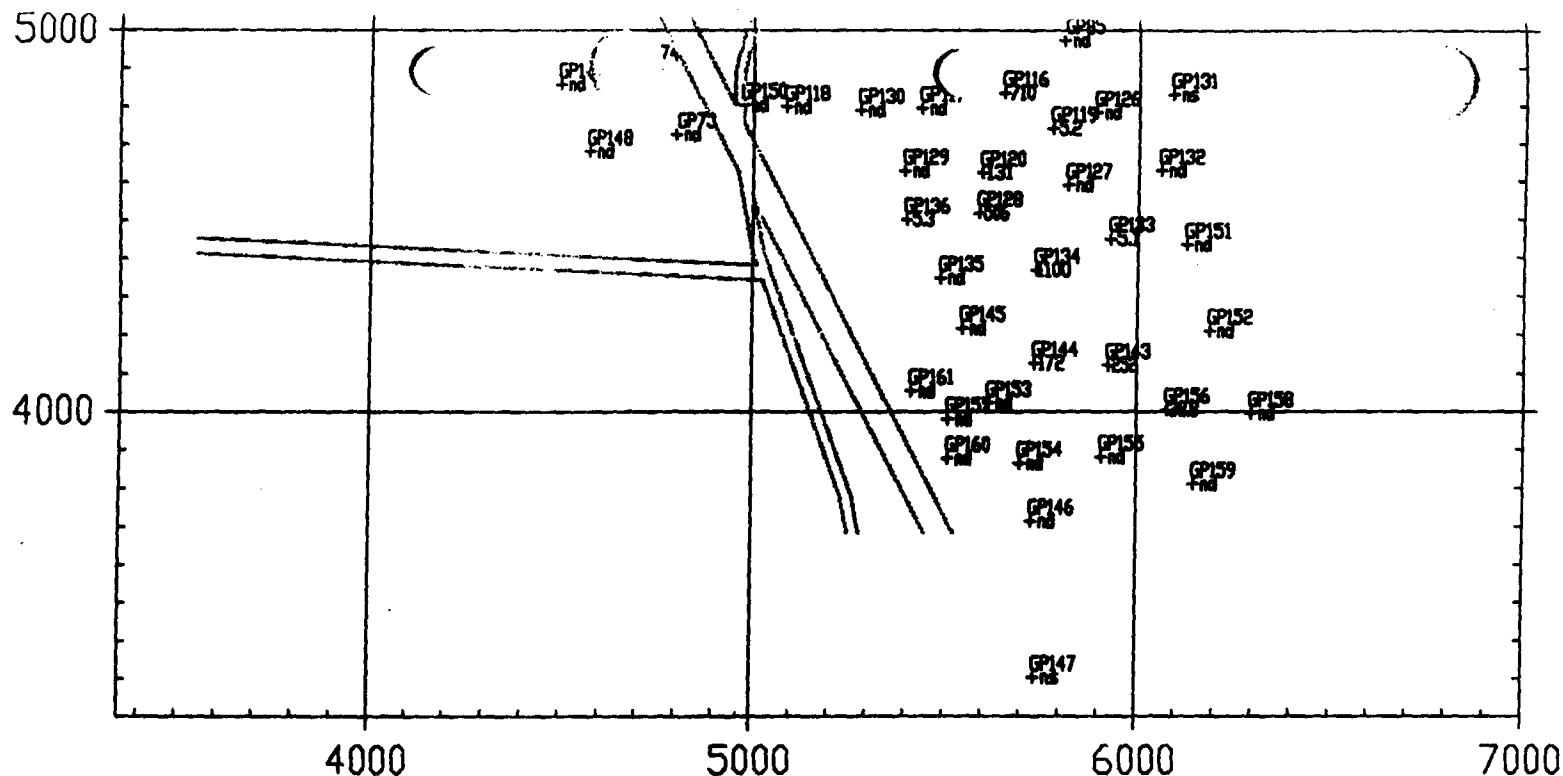
References

Revisions

This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.

QUALITY CONTROL	Graphic Standards GCM	3-13-86	Technical Review	Management Review
	Lead Professional		Project Manager	Other





LEGEND

- GP148
nd GROUNDWATER SAMPLING POINT
LOCATION AND NUMBER, WITH TOTAL
VOLATILE ORGANIC COMPOUNDS (ug/L)
- nd NOT DETECTED
- ns NOT SAMPLED
- na NOT ANALYZED
- ☒ FORMER UNDERGROUND STORAGE TANK LOCATION

NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON OCTOBER 30, 1995.
2. LOCATION FOR GP54 ESTIMATED - SAMPLING POINT NOT SURVEYED.

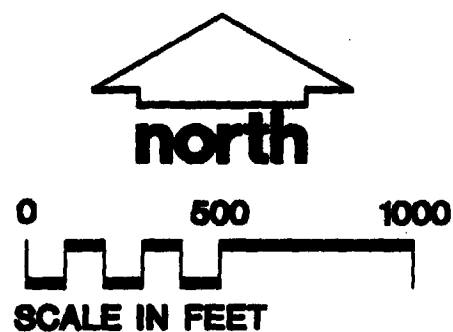


FIGURE 3

<div style="writing-mode: vertical-rl; transform: rotate(180deg);"> MONTGOMERY WATSON </div>	<div style="writing-mode: vertical-rl; transform: rotate(180deg);"> 4077.0072 B </div>	UPPER AQUIFER PLOT OF BENZENE DETECTIONS (ug/L)		Developed By PV	Drawn By CCM
		UPPER AQUIFER INVESTIGATION AMERICAN CHEMICAL SERVICE, INC. NPL SITE GRIFFITH, INDIANA		Approved By PSVA	Date 7/24/96
				Reference	
				Revisions	

This document has been developed for a specific application and may not be used without the written approval of Montgomery Watson.

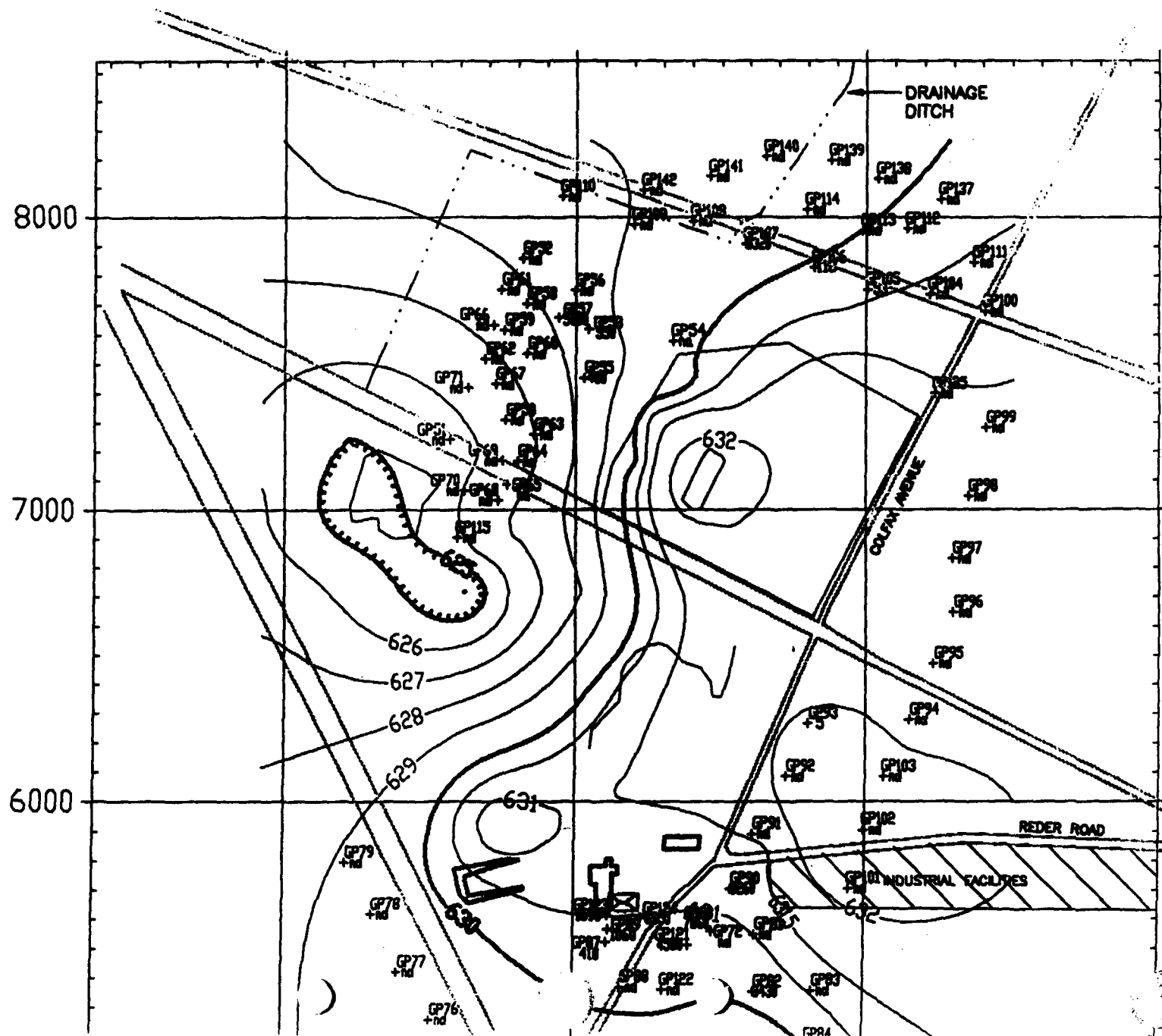
QUALITY
CONTROL

Graphic Standards GCM
Lead Professional

3-13-86

Technical Review
Project Manager

Management Review
Other



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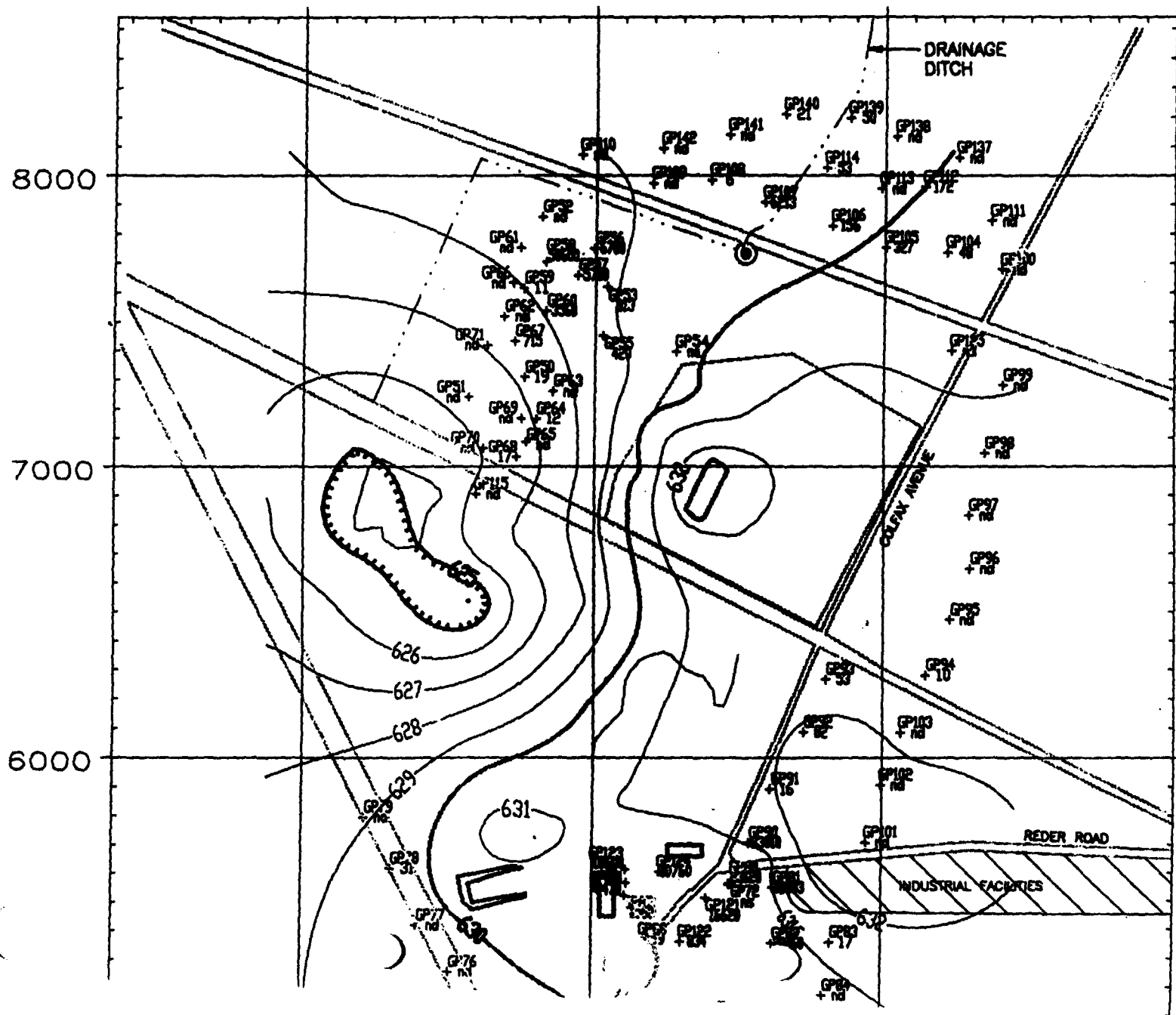
QUALITY
CONTROL

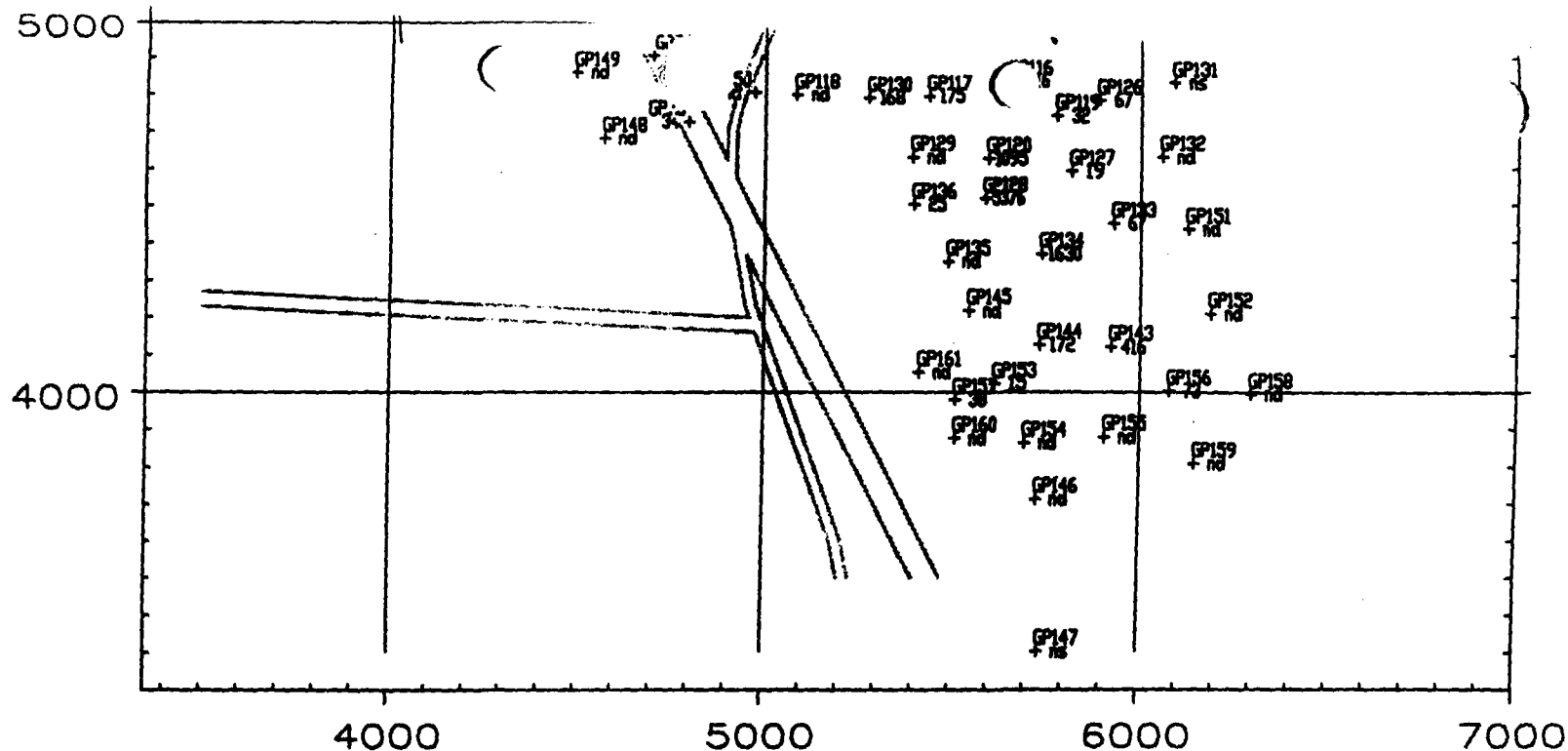
Graphic Standards CCM
Lead Professional

4-30-85

Technical Review
Project Manager

Management Review
Other





LEGEND

- GP148 GROUNDWATER SAMPLING POINT
LOCATION AND NUMBER, WITH TOTAL
VOLATILE ORGANIC COMPOUNDS (ug/L)
- SURFACE WATER SAMPLE
- NOT DETECTED
- NOT SAMPLED
- NOT ANALYZED
- FORMER UNDERGROUND STORAGE TANK LOCATION

NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS
WERE MEASURED AT THE SITE ON OCTOBER 30, 1985.
2. LOCATION FOR GP54 ESTIMATED - SAMPLING POINT
NOT SURVEYED.

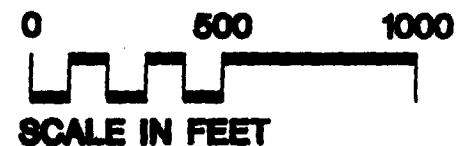


FIGURE 6



MONTGOM
WATSON

Drawing Number
4077.0072

TOTAL VOC CONCENTRATIONS
IN UPPER AQUIFER (ug/L)

UPPER AQUIFER INVESTIGATION
AMERICAN CHEMICAL SERVICE, INC.
NPL SITE

Developed By PV

Drawn By CCM










Approved By *PV*

Date 7/24/86

Reference

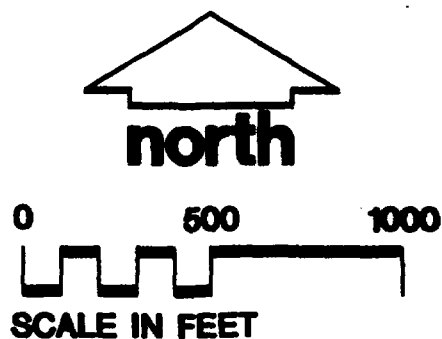
Revisions

LEGEND

-  PROPOSED UPPER AQUIFER MONITORING WELLS
-  PROPOSED RESIDENTIAL WELL SAMPLES
-  UPPER AQUIFER WELL LOCATION AND NUMBER
-  LEACHATE/UPPER AQUIFER WELL LOCATION AND NUMBER
-  PIEZOMETER LOCATION AND NUMBER
-  GROUNDWATER SAMPLING POINT
-  TOTAL VOC CONCENTRATIONS GREATER THAN DETECTION LIMITS
-  N-1 PROPOSED PIEZOMETER NEST LOCATION
-  FORMER UNDERGROUND STORAGE TANK LOCATION

NOTES

1. GROUNDWATER LEVELS FOR WATER TABLE CONTOURS WERE MEASURED AT THE SITE ON OCTOBER 30, 1995.



Developed By PV
 Drawn By CCM
 Approved By *PSA*
 Date 7/24/96
 Reference
 Revisions

LOCATION OF PROPOSED MONITORING WELLS AND RESIDENTIAL WELL SAMPLING
 UPPER AQUIFER INVESTIGATION
 AMERICAN CHEMICAL SERVICE, INC.
 NPL SITE
 GRIFFITH, INDIANA

Drawing Number
 4077.0072 **B2**

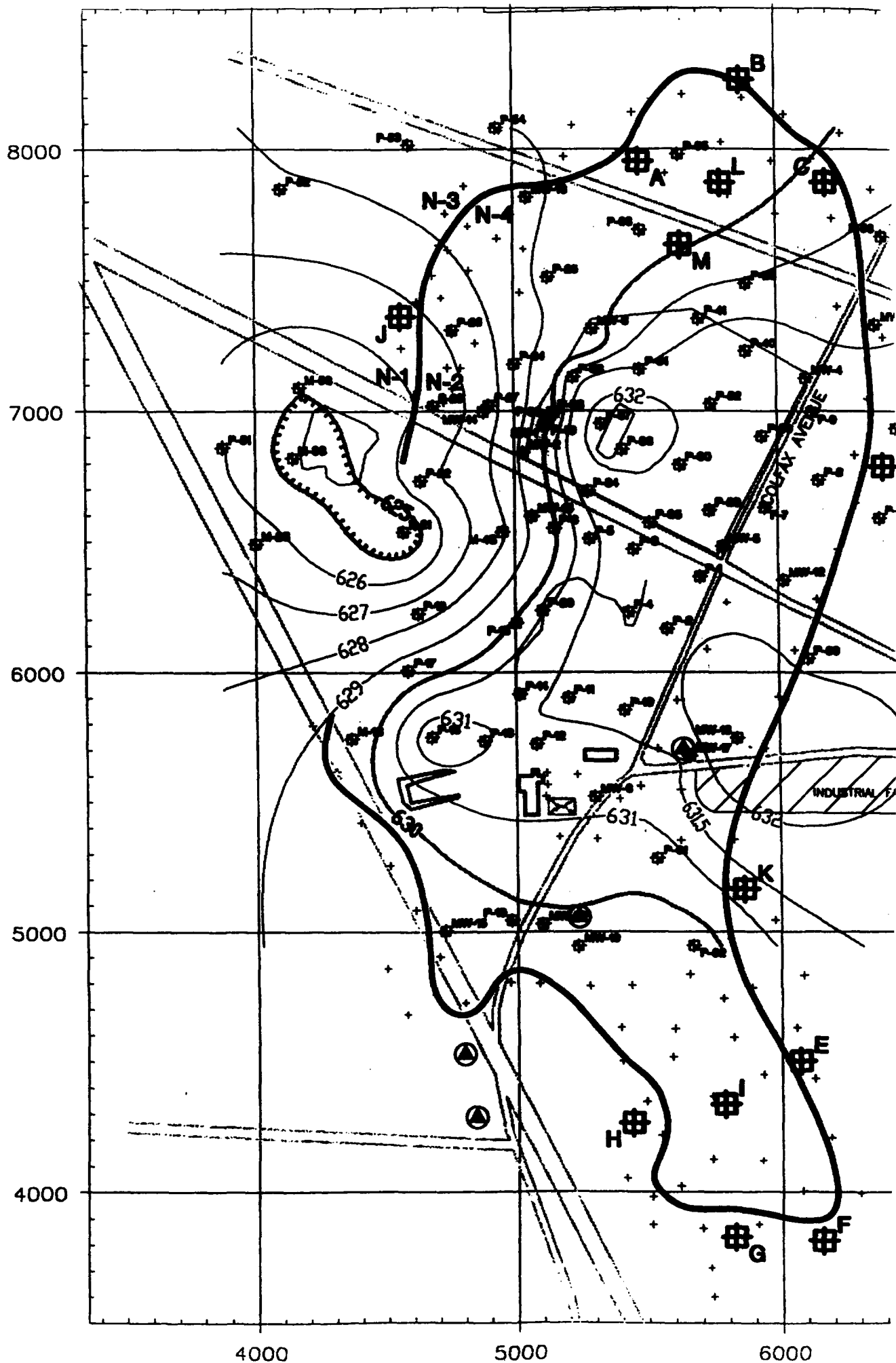
MONTGOMERY WATSON



FIGURE 6

7000

Managemt _____
Other _____



A

**TABULATION OF VOC ANALYSES
WITH FIELD GC**

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP50	GP50A	GP51	GP51A	GPFB 1/24/96	GPTB 1/24/96	GP52	GP53	GP55	GP56
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	19	44						210	15	6700
1,1 Dichloroethene										
trans 1,2 Dichloroethene								23	5	
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene								7		
1,2 Dichloroethane										
1,1,1 Trichloroethane										
Benzene								550	400	
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)										
1,1,2 Trichloroethane										
Toluene								23		
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene										
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	19	44	0	0	0	0	0	813	420	6700

Notes:

ug/L - Micrograms per liter

Values in *italics* exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP57	GP58	GP59	GP60	GP61	GP62	GP63	GP64	GP65	GPTB 1/25/96
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	770	50600	11	3560				12		
1,1 Dichloroethene										
trans 1,2 Dichloroethene										
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene										
1,2 Dichloroethane										
1,1,1 Trichloroethane										
Benzene	5000									
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)										
1,1,2 Trichloroethane										
Toluene										
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene										
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	5770	50600	11	3560	0	0	0	12	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GPFB 1/25/96	GP66	GP67	GP68	GP68 Dup	GP69	GP70	GP71		GP73
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone			715	16.9	20.8					34
1,1 Dichloroethene										
trans 1,2 Dichloroethene										
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene										
1,2 Dichloroethane										
1,1,1 Trichloroethane										
Benzene										
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)										
1,1,2 Trichloroethane										
Toluene										
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene										
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	0	0	715	16.9	20.8	0	0	0	0	34

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP74	GPTB 1/26/96	GPFB 1/26/96	GP75	GP76	GP77	GP78	GPFB 1/31/96	GP79	GP80	GP81	GP82
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	57						31.1	13			1720	4450
1,1 Dichloroethene												
trans 1,2 Dichloroethene												
1,1 Dichloroethane												
2-Butanone (MEK)												
cis 1,2 Dichloroethene												
1,2 Dichloroethane			15.4					10.1		317	2770	3460
1,1,1 Trichloroethane											445	
Benzene										7860		3430
Carbon tetrachloride												
Trichloroethene												
4-Methyl-2-pentanone (MIBK)												
1,1,2 Trichloroethane												
Toluene										253	658	
Tetrachloroethene												
Chlorobenzene												
Ethylbenzene										3100	3110	4320
m+p Xylene										10800	10100	13800
Styrene												
o Xylene										790		
TOTAL VOCs (ug/L)	57.4	0	15.4	0	0	0	31.1	23.1	0	23120	18803	29460

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP83	GPTB 1/31/96	GP84	GP85	GP85 Dup	GP86	GPFB 2/1/96	GPTB 2/1/96	GP87	GP87 Dup	GP88
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone									3900	3000	159
1,1 Dichloroethene											
trans 1,2 Dichloroethene											
1,1 Dichloroethane											
2-Butanone (MEK)											
cis 1,2 Dichloroethene											
1,2 Dichloroethane		44.4									
1,1,1 Trichloroethane											
Benzene									410	420	
Carbon tetrachloride											
Trichloroethene											
4-Methyl-2-pentanone (MIBK)											
1,1,2 Trichloroethane											
Toluene											
Tetrachloroethene											
Chlorobenzene											
Ethylbenzene									250	260	
m+p Xylene	16.7									32	
Styrene											
o Xylene											
TOTAL VOCs (ug/L)	16.7	44.4	0	0	0	0	0	0	4560	3712	159

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP89	GPFB 2/5/96	GPTB 2/5/96	GPFB 2/6/96	GP90	GP91	GP92	GP93	GP94	GP95	GP96	GP97
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	2910				3960		81.5	42.7				
1,1 Dichloroethene												
trans 1,2 Dichloroethene												
1,1 Dichloroethane					940							
2-Butanone (MEK)					504							
cis 1,2 Dichloroethene					25700							
1,2 Dichloroethane									10			
1,1,1 Trichloroethane					226							
Benzene	1060				8260			5				
Carbon tetrachloride												
Trichloroethene												
4-Methyl-2-pentanone (MIBK)					8960	10.1						
1,1,2 Trichloroethane												
Toluene					18300							
Tetrachloroethene												
Chlorobenzene								5.6				
Ethylbenzene	1050				4530							
m+p Xylene	4450				18800	6.1						
Styrene												
o Xylene					2830							
TOTAL VOCs (ug/L)	9470	0	0	0	93010	16.2	81.5	53.3	10	0	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP98	GPTB 2/6/96	GP99	GP100	GP101	GP102	GP103	GP104	GPTB 2/6/96	GP105	GP106
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone								47.9		205	37.5
1,1 Dichloroethene										7.2	
trans 1,2 Dichloroethene											
1,1 Dichloroethane										20.1	
2-Butanone (MEK)											
cis 1,2 Dichloroethene										42.1	
1,2 Dichloroethane											
1,1,1 Trichloroethane											
Benzene										52.5	118
Carbon tetrachloride											
Trichloroethene											
4-Methyl-2-pentanone (MIBK)											
1,1,2 Trichloroethane											
Toluene											
Tetrachloroethene											
Chlorobenzene											
Ethylbenzene											
m+p Xylene											
Styrene											
o Xylene											
TOTAL VOCs (ug/L)	0	0	0	0	0	0	0	47.9	0	326.9	155.5

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP107	GPFB 2/6/96	GPTB 2/7/96	GPFB 2/7/96	GPFB 2/7/96 Dup	GP108	GPFB 2/8/96	GP109	GP110	GP111
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	860									
1,1 Dichloroethene										
trans 1,2 Dichloroethene	14.3									
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene										
1,2 Dichloroethane				24	23.2					
1,1,1 Trichloroethane				12	12.3					
Benzene	5320									
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)	18.4					6.1				
1,1,2 Trichloroethane										
Toluene										
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene										
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	6212.7	0	0	35.9	35.5	6.1	0	0	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP112	GP113	GP114	GP115	GPTB 2/8/96	GP116	GP117	GP118	GP119	GP120	GP121	GP122
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	172		53.3			240	175		16.6	719	4780	834
1,1 Dichloroethene												
trans 1,2 Dichloroethene												
1,1 Dichloroethane												
2-Butanone (MEK)												
cis 1,2 Dichloroethene												
1,2 Dichloroethane												
1,1,1 Trichloroethane												
Benzene						710			5.2	131	4580	
Carbon tetrachloride												
Trichloroethene												
4-Methyl-2-pentanone (MIBK)												
1,1,2 Trichloroethane												
Toluene												
Tetrachloroethene												
Chlorobenzene						49.6			10.6			
Ethylbenzene						666					635	
m+p Xylene						4550				245	6625	
Styrene												
o Xylene												
TOTAL VOCs (ug/L)	172	0	53.3	0	0	6215.6	175	0	32.4	1095	16620	834

Notes:

ug/L - Micrograms per liter

Values in *italics* exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GPTB 2/12/96	GP57A	GP68A		GP132	GP133	GP133	GPFB 2/19/96	GPTB 2/19/96	GP134	GP135
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone		1400	348			61.6	58			412	
1,1 Dichloroethene											
trans 1,2 Dichloroethene											
1,1 Dichloroethane											
2-Butanone (MEK)											
cis 1,2 Dichloroethene											
1,2 Dichloroethane											
1,1,1 Trichloroethane											
Benzene		44700				5.1	5.1			1100	
Carbon tetrachloride											
Trichloroethene											
4-Methyl-2-pentanone (MIBK)											
1,1,2 Trichloroethane											
Toluene											
Tetrachloroethene											
Chlorobenzene										84.1	
Ethylbenzene										16.5	
m+p Xylene										16.1	
Styrene											
o Xylene											
TOTAL VOCs (ug/L)	0	46100	348	0	0	66.7	63.1	0	0	1628.7	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP136 (R)	GP137 (R)	GP138 (R)	GP139	GP139 Dup	GP140 (R)	GP141 (R)	GP142 (R)	GPFB 2/20/96	GPTB 2/20/96	GP52A
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	19.2			50.2	32.4	21.3					
1,1 Dichloroethene											
trans 1,2 Dichloroethene											
1,1 Dichloroethane											
2-Butanone (MEK)											
cis 1,2 Dichloroethene											
1,2 Dichloroethane											
1,1,1 Trichloroethane											
Benzene	5.3										
Carbon tetrachloride											
Trichloroethene											
4-Methyl-2-pentanone (MIBK)											
1,1,2 Trichloroethane											
Toluene											
Tetrachloroethene											
Chlorobenzene											
Ethylbenzene											
m+p Xylene											
Styrene											
o Xylene											
TOTAL VOCs (ug/L)	24.5	0	0	50.2	32.4	21.3	0	0	0	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP143	GP144	GP145	GPTB 2/21/96	GPFB 2/21/96	GP66A	GP70A	GP71A	GP146	GPTB 2/29/96
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	58.5									
1,1 Dichloroethene										
trans 1,2 Dichloroethene										
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene										
1,2 Dichloroethane										
1,1,1 Trichloroethane										
Benzene	252	172								
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)										
1,1,2 Trichloroethane										
Toluene										
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene	105									
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	415.5	172	0	0	0	0	0	0	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96		GP148	GP149	GP150	GP151	GP152	GP153	GPFB 3/1/96	GPTB 3/1/96	GP154	GP155
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone							15				
1,1 Dichloroethene											
trans 1,2 Dichloroethene											
1,1 Dichloroethane											
2-Butanone (MEK)											
cis 1,2 Dichloroethene											
1,2 Dichloroethane											
1,1,1 Trichloroethane											
Benzene											
Carbon tetrachloride											
Trichloroethene											
4-Methyl-2-pentanone (MIBK)											
1,1,2 Trichloroethane											
Toluene											
Tetrachloroethene											
Chlorobenzene											
Ethylbenzene											
m+p Xylene											
Styrene											
o Xylene											
TOTAL VOCs (ug/L)	0	0	0	0	0	0	15	0	0	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP156	GP157	GP158	GP159	GP160	GP161	GPFB 3/4/96	GPTB 3/4/96	SW101
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	34	38			<20				
1,1 Dichloroethene									
trans 1,2 Dichloroethene									
1,1 Dichloroethane									
2-Butanone (MEK)									
cis 1,2 Dichloroethene									
1,2 Dichloroethane									
1,1,1 Trichloroethane									
Benzene	38.8								1180
Carbon tetrachloride									
Trichloroethene									
4-Methyl-2-pentanone (MIBK)									
1,1,2 Trichloroethane									
Toluene									
Tetrachloroethene									
Chlorobenzene									
Ethylbenzene									
m+p Xylene									
Styrene									
o Xylene									
TOTAL VOCs (ug/L)	72.8	38	0	0	0	0	0	0	1180

Notes:

ug/L - Micrograms per liter

Values in *italics* exceeded the Calibration linear range at the dilution analyzed.

A

**TABULATION OF VOC ANALYSES
WITH FIELD GC**

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP50	GP50A	GP51	GP51A	GPFB 1/24/96	GPTB 1/24/96	GP52	GP53	GP55	GP56
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	19	44						210	15	6700
1,1 Dichloroethene										
trans 1,2 Dichloroethene								23	5	
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene								7		
1,2 Dichloroethane										
1,1,1 Trichloroethane										
Benzene								550	400	
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)										
1,1,2 Trichloroethane										
Toluene								23		
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene										
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	19	44	0	0	0	0	0	813	420	6700

Notes:

ug/L - Micrograms per liter

Values in *italics* exceeded the Calibration linear range at the dilution analyzed.

Appendix A
Summary of Upper Aquifer Field Screening Results
American Chemical Service, Inc.
Griffith, Indiana

chk'd to 3/14/96	GP57	GP58	GP59	GP60	GP61	GP62	GP63	GP64	GP65	GPTB 1/25/96
Compound - Field GC	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L
Acetone	770	50600	11	3560				12		
1,1 Dichloroethene										
trans 1,2 Dichloroethene										
1,1 Dichloroethane										
2-Butanone (MEK)										
cis 1,2 Dichloroethene										
1,2 Dichloroethane										
1,1,1 Trichloroethane										
Benzene	5000									
Carbon tetrachloride										
Trichloroethene										
4-Methyl-2-pentanone (MIBK)										
1,1,2 Trichloroethane										
Toluene										
Tetrachloroethene										
Chlorobenzene										
Ethylbenzene										
m+p Xylene										
Styrene										
o Xylene										
TOTAL VOCs (ug/L)	5770	50600	11	3560	0	0	0	12	0	0

Notes:

ug/L - Micrograms per liter

Values in Italics exceeded the Calibration linear range at the dilution analyzed.

B

FIELD GC PRINTOUTS AND PLOTS
(AVAILABLE UPON REQUEST)

C

UPPER AQUIFER INVESTIGATION SOPs

SPECIFIC OPERATING PROCEDURES

**American Chemical Service Inc.
Griffith, Indiana**

MONITORING WELL DEVELOPMENT PROTOCOL

Subject: Monitoring Well Development

Method: Surge and Purge using submersible pump

Well development should not occur within 24 hours after well construction if annular space is grouted. Grout must set up prior to development.

I. PRE-FIELD CHECKLIST

A. Paperwork to take to the site

1. Completed monitoring well construction field QC summary for the wells to be developed
2. Completed monitoring well construction summary for the wells to be developed
3. Monitoring well development summary forms
4. Health and Safety Plan

B. Equipment to take to the site

1. Field Notebook
2. Plastic sheeting
3. Electronic water level indicator
4. 5 gallon bucket
5. Plan for disposal of water
6. Decon solutions
7. pH meter
8. Specific conductance meter
9. Turbidity meter
10. Pumps (GRUNDFOS)
11. PVC or stainless steel bailer
12. Hand tools (socket set, hammer)

13. Sample bottles and preservatives
14. Well access (keys, flushmount access, off-site property access agreement)
15. Drums or poly tank for containing purge water

II. FIELD CHECKLIST

- A. Well Labeled?
- B. Surficial seal in good shape?
- C. Flushmount cover and protective cover in good shape?
- D. Lock in good shape? Lubricated with graphite?
- E. Sand drainage inside flushmount or protective casing?
- F. Vent hole in well cap? (stick up wells)
- G. Water tight cap loosened, water level equilibrated? (flushmount wells)
- H. Weep hole in protective casing?

III. WELL DEVELOPMENT

- A. Measure depth to water from top of the well casing with an electronic water level indicator.
- B. Measure total depth from top of well casing with an electronic water level indicator.
- C. Compare measured total well depth with total well depth reported on the QC summary. The difference is the amount of sediment in the well bottom.
- D. Calculate the total volume of water contained in the well plus the volume of water in the sand pack:

Total Volume = well volume + sand pack volume

Well Volume (gallons) = $0.16(r^2)(L)$

Where r = inside well radius in inches

L = length of water column in feet

Sand Pack Volume (Gallons) = $0.057(R^2 - r^2)L$

Where R = borehole radius in inches

r = outside well radius in inches

L = saturated length of sand pack in feet

(assumes sand pack porosity of 35%)

- E. Alternately surge and purge the well using a PVC/stainless steel bailer or submersible pump. Let the bailer or pump sink to the well bottom. Forcefully pull it up through the screen length and let it settle back to the bottom. This agitation suspends sediment in the well bottom and moves fines in and out of the well screen. If using a bailer, pull out the bailer and discharge the water into a 5 gallon bucket. If using a submersible pump, allow the pump to purge water into a 5 gallon bucket during the surging

process. Note the color, odor, and turbidity of the purge water in the field notebook. Repeat this surge and purge cycle for about 20-30 minutes.

- F. After surging and purging for 20-30 minutes, purge three well and sand pack volumes from the well using a submersible pump (GRUNDFOS) or bailer. A submersible pump will be used if a sustainable flow rate from the well can be achieved. If the well is purged dry, a pump or bailer may be used for development. A well which purges dry is one that can be pumped down to the bottom and does not recover 50% of the well volume within 30 minutes.
- G. For wells that cannot be purged dry, the purge water will be tested for pH, specific conductivity, temperature, and turbidity at regular volume intervals after three well and sand pack volumes have been initially removed. If, after purging five well and sand pack volumes from the well, the readings of pH, specific conductivity, temperature, and turbidity are stabilized within 10% over three consecutive measurements, well development will be completed for the well. If parameter measurements have not stabilized within 10%, purging will continue until either stabilization has been achieved or a maximum of 10 well and sand pack volumes have been removed from the well.
- H. For wells that purge dry, slowly purge the well using a pump or bailer. The purge water will be tested for pH, specific conductivity, temperature and turbidity at the end of each well plus sand pack volume. If possible, three to five well and sand pack volumes will be removed. Return trips to the well on the same day, or overnight may be necessary.
- I. If a submersible pump is used for purging, do not allow the pump to rest stationary at the well bottom. If the pump motor is positioned at the base of the pump, resting the pump at the bottom of the well will not let water flow around the motor, potentially allowing the motor to overheat. The maximum sustainable pumping rate utilized during purging will be measured by determining the length of time required to fill a 5-gallon bucket. This information will be recorded in the field notebook.

IV. MANAGEMENT OF DEVELOPMENT WATER

- A. Purge water will be contained by pumping purge water into drums (steel or plastic) at each well location, or by pumping into a plastic holding tank located on the back of a pick up truck. If the water is contained in drums, the drums will be moved to the off-site containment area for staging following completion of well development activities. If the water is contained in the plastic tank during purging, the tank will then be removed to the off-site containment area and the water will be pumped into drums and staged for future disposal. Water will be carefully pumped into the drums with enough space left in the drums to allow for freezing of water without causing the drums to crack, or leak.

V. EQUIPMENT DECONTAMINATION

A. Development equipment (bailer, submersible pump, pump tubing) will be decontaminated between monitoring wells as follows:

- Wash with water and nonphosphate detergent (Alconox)
- Rinse with tap water
- Rinse with distilled water

B. Water generated during decontamination will be collected and containerized in 55-gallon drums. The drums will then be sealed, labeled and stored in the off-site containment area for future disposal.

V. DOCUMENTATION

A. Monitoring Well Development Summary

1. Record method of surging and purging, time spent developing and total volume purged into field notebook.
2. Record time, pH, specific conductivity, temperature, and turbidity measurements into field notebook.
3. For wells where development was conducted with a submersible pump, record the maximum pumping rate used.

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SPECIFIC OPERATING PROCEDURES

**UPPER AQUIFER INVESTIGATION
American Chemical Service Inc.
Griffith, Indiana**

PRIVATE WELL SAMPLING

Scope and Application: To provide guidelines for collection of private well water samples.

Reagents and Apparatus:

1. Assorted tools
2. Sample containers, sample labels
3. Chain-of-Custody forms
4. Cooler with ice

Procedure:

1. Schedule sampling with residential property owners.
2. Label all sample containers prior to collection.
3. Locate the untreated, cold water source as near to the well head as practicable. If possible, the sample should be collected directly off the tap between the pump and the pressure tank. Verify that the sample has not passed through any type of treatment system (water softener, iron filter, hot water heater, etc.). Record the exact location the sample was taken.
4. If a sampling location cannot be located directly off the pressure tank or from a tap between the pump and the pressure tank the following sampling procedure should be used:

The well/pressure tank system should be purged by allowing the water to run for a minimum of ten minutes, or until the pump has cycled at least once. After the water has run for ten minutes, or the pump has cycled it can be assumed that the running water represents new formation water and a sample can be collected for analysis.

5. Fill appropriate containers for laboratory analysis.

6. Clean up sampling area if necessary.

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SPECIFIC OPERATING PROCEDURES

**American Chemical Service Inc.
Griffith, Indiana**

GROUNDWATER MONITORING WELL SAMPLING

Subject: Groundwater Monitoring Well Sampling

Method: Low Flow Sampling with Submersible Pump

I. PRE-FIELD CHECKLIST

A. Paperwork to take to the site

1. Completed monitoring well construction summary for the wells to be sampled
2. Monitoring well development summary forms
3. Health and Safety Plan

B. Equipment to take to the site

1. Field Notebook
2. Watch, or timing device
3. Electronic water level indicator
4. 5-gallon bucket
5. Plan for disposal of water
6. Decon solutions and buckets
7. pH meter
8. Specific conductance meter
9. Turbidity meter
10. Pump (Grundfos), generator, extension cord (50 feet)
11. Polyethylene tubing, hose clamps
12. Graduated container
13. Hand tools (socket set, hammer)
14. Sample bottles (EPA540/R93/051/Dec/92) and preservatives (HCL and HNO₃)
15. Sample labels and tags
16. Well access (key)
17. Drums or poly tank for containing purge water
18. Cooler(s) with ice

19. Packing material (vermiculite, tape)
20. Chain of custody forms

II. LOW FLOW SAMPLING WITH SUBMERSIBLE PUMP

- A. Measure and record depth to water from top of the well casing with electronic water level indicator. Examine the water level indicator for evidence of sheen, oily surface or other immiscible fluids and record this information in the field log book.
- B. Measure and record total depth from top of well casing with electronic water level indicator.
- C. Refer to monitoring well construction summary for depth to top of the well screen. Attach new, clean polyethylene tubing to the Grundfos pump. (Teflon® tubing was considered for sampling purposes but not selected due to its excessive rigidity which makes the tubing difficult to attach to the pump and handle while raising and lowering the pump in the well. This material is more ideally suited and typically utilized for dedicated well sampling systems, including bladder pumps or Waterra inertial lift pumps).
- D. Lower the Grundfos pump so that the pump rests approximately one foot above the well screen.
- E. Begin purging the well at a rate of approximately 300 ml per minute. Confirm the purge rate by measuring the amount of water purged in one minute with a graduated measuring device, such as a bucket, or sample container. Observe the purge water for evidence of a sheen, oily surface or other immiscible fluids and record this information in the field log book.
- F. While purging, field measurements for pH, specific conductance, temperature, and turbidity will be monitored. Measurements of pH, specific conductance, and temperature will be collected in-line or by inserting instrument probes into a bypass stream of water from continuous pump discharge. The bypass stream will be directed into a sample container (250 ml poly jar) for parameter measurement. Turbidity measurements will be collected from the bypass stream into its own collection and measurement device.
- G. When pH, specific conductivity, temperature, and turbidity readings have stabilized for three consecutive readings within 10% of the previous readings, sample bottles can then be filled. Samples collected for volatile organic analyses shall be filled first. Samples shall be placed in a cooler and iced immediately after collection.
- H. Purge water will be contained by placing purge water into drums (steel or poly) at each well location, or by pumping into a poly holding tank which can be

- f. Date and time of collection
 - g. Sample designation (QA/QC, grab or composite)
 - h. Sample matrix
 - i. Number and size of containers
 - j. Analyses requested
 - k. Signature of individual involved with custody transfer (including date and time of transfer)
2. COC records initiated in the field will be signed, placed in a plastic "zip-lock" bag, and secured inside of the shipping container used for sample transport. Signed air bills will serve as evidence of custody transport between the field sampler and courier as well as the courier and laboratory. Copies of the COC record and the air bills will be retained and filed by the sampler prior to shipment.

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SPECIFIC OPERATING PROCEDURES

**UPPER AQUIFER INVESTIGATION
American Chemical Service Inc.
Griffith, Indiana**

GROUNDWATER MONITORING WELL INSTALLATION PROTOCOL

Scope and Application: This method is applicable to installing upper aquifer groundwater monitoring wells.

I. PRE-FIELD CHECKLIST

- A. Health and Safety Plan with related instruments
- B. Underground Utility Check: 5 to 7 day advance notice required
- C. Off-Site access agreements completed
- D. Statement of Work detailing sample types, sample intervals, drilling and sampling methods
- E. Field boring logs (Montgomery Watson Standard)
- F. Daily Drilling Summary
- G. Unified Soil Classification System summary
- H. Decon solutions, brushes, buckets
- I. Soil jars (Laboratory Grade and Driller's Grade)
- J. Jar labels
- K. Driller contacted and informed
 - 1. Health and Safety Plan
 - 2. Utility check
 - 3. Statement of Work/Sampling Plan
- M. 150 foot tape measure

- N. Pocket penetrometer
- O. Soil knife/spatula
- P. Utility Knife
- Q. Well Construction Forms
- R. Well Development Forms

II. FIELD CHECKLIST

- A. Check for unmarked or uncleared utilities, drive around, walk around
- B. Check for overhead wires
- C. Drill rig access
- D. Health and Safety Briefing
- E. Borehole location correctly staked and labeled
- F. Steam clean drill rods, casing, bits, split-spoon samplers, hand tools, drill rig
- G. Count number of drill rods to determine the number used during drilling and therefore, the total depth drilled
- H. Confirm the correct well construction materials are present
- I. Prepare soil jars

III. SOIL BORINGS

Soil borings will be advanced using 4.25 inch inner diameter (ID) hollow stem augers (HSA). Soil samples will be collected using a 2-inch diameter split-spoon sampler at 2.5 ft sampling intervals (i.e. 1 to 2.5 feet, 3.5 to 5 feet, etc.). Soil samples collected will be visually inspected and classified according to the Unified Soil Classification System (USCS).

- A. Split Spoon Sampling
 - 1. Inspect split spoon

- a. Measure length of spoon from tip to shoe.
 - b. Spoon tip must not be gouged, bent, or excessively worn
 - c. Spoon must have a check valve; the check valve should be free of soil and be able to seal.
 - d. Spoon tip may contain a spring sample catcher which is clean and in good working order.
 - e. Split spoon samplers should be cleaned between boring locations using steam cleaning. Split spoons will be washed between sampling intervals using a TSP/Liquinox wash followed by a distilled water rinse
2. Handling Split Spoon Sample - Logging Soils
- a. Carefully open split spoon sampler. Do not slam the split spoon to open.
 - b. Recognize and disregard any soil plug, sluff, or blow-in at the upper portion of the sample.
 - c. Measure and record sample recovery.
 - d. Perform pocket penetrometer test on cohesive soils if encountered.
 - e. Describe and record the soil sample in accordance with the Unified Soil Classification System (USCS).
3. At a minimum, split spoon sampling will be advanced two feet into the clay confining layer.

IV. INSTALLATION OF MONITORING WELLS

Monitoring wells are constructed of 2 inch diameter stainless steel material, and fitted with ten foot screens.

The elevation to place the screen will be based on the depth to the water table at each location. Typical water table monitoring wells are screened so that 2 to 3 ft of the top of the well screen is installed above the unsaturated zone to allow for water table fluctuation. In areas where the water table is high (areas of standing water, wetlands, etc.), each well will be screened so that a minimal seal can be installed. If the water table is within 3 feet of the ground surface, the monitoring wells will be installed such that the bottom of the well screen is set at approximately 13 ft. This

will bring the top of the well screen to approximately 3 ft below ground surface, which will allow for a bentonite seal. Each monitoring well or piezometer will be installed through the 4.25 inch inner diameter hollow stem augers that was used to advance the borehole to its desired depth.

A. Before Well Installation

1. Inspect screen and riser pipe inside and out for cleanliness, defects, gouges, cracks: reject any failed pieces.
2. Accurately measure length of screen piece including blank sections.
3. Measure total length of slotted interval
4. Accurately measure length of each riser piece.
5. Count the number of riser pieces to confirm accurate total length of well.
6. Inspect filter pack material: proper gradation, proper material, contaminant free, sufficient quantity.
7. Inspect bentonite chips or pellets: Bentonite chips or pellets should be 3/8" in size.

B. During Well Installation

1. Determine depth of well placement as total length of assembled well string minus height of well string to above ground surface.
2. Riser pieces should have water tight joints: either neoprene gaskets or Teflon tape. Do not use glue or solvent cement.
3. Accurately determine total well depth.
 - a. Measure length of well riser pipe piece cut off from the total length of well string.
 - b. Total well string length minus length of cut off piece equals total well depth (TD) measured from top of casing (TOC).
 - c. The well top should stick up a minimum of 24 inches above the ground surface.
4. Install a temporary well cap to prevent any materials from falling into the well. Lower well string down into the casing to the predetermined depth.
5. Filter pack construction

- a. Introduce a well graded sand in a controlled manner: slowly add filter sand. Slowly retract the hollow stem augers surrounding the screen.
 - b. Filter pack will extend from 6 inches below the well bottom to 2 feet above the top of the well screen, if possible. In areas where the water table is close to ground surface (generally within 3 ft of the ground), 1 ft of filter pack above the screen is essential so that a seal can still be installed.
 - c. Periodically use tape measure to check for bridging and to show height of filter pack in comparison to the well screen.
6. Bentonite Seal:
 - a. Use bentonite chips or pellets no larger than 3/8 inch in diameter when placing seal through water.
 - b. Place minimum two feet of bentonite seal above the filter pack.
 - c. Place 6 inches of fine sand on top of the bentonite seal
 - d. Record the type, size, and volume of sealant placed.
7. Annular Space Seal. All permanent monitoring wells will have an annular space seal which extends from the top of the filter pack seal to the bottom of the ground surface seal and will have a minimum two foot length.
 - a. For water table wells with the water table at 7 feet or less below ground surface, use granular bentonite only; place the bentonite in 2 foot lifts, hydrating each lift
 - b. Use granular bentonite.
 - (1) When there is no standing water in the borehole and the placement depth is less than 25 ft.
 - (2) The depth to the water table is less than 7 ft. below ground surface.
 - c. Record type and volume of annular space seal.
8. Construct ground surface seal. Check for annular space seal settlement. If grout or slurry is used as the annular space seal, wait 24 hours after seal installation before installing the surface seal. If the water table is within 7 ft of the ground surface, surface seal may be installed after the bentonite seal has been placed above the filter pack.
 - a. Stick up well protective pipe.
 - (1) Measure the length of well protective pipe.

- (2) Subtract well stick up height to get embedment depth of well protective pipe.
- (3) If the well protective pipe embedment depth intersects the filter pack or filter pack seal, then shorten the length of the well protective pipe. The minimum embedment depth should not be less than the stick up height. If the water table is within 7 ft of the ground surface, this may be modified so that the minimum embedment is less than the stick up height.
- (4) The ground surface seal will start at least 5 ft. below ground surface, if the water table depth is at least 7 ft below ground surface. However, if the depth to water is less than 7 ft, the ground surface seal will be set at a minimum of 1 ft above the top of the well screen so that the protective casing does not intersect the well screen.
- (5) Place bentonite chips, pellets or granules up to 1 ft. below the well protective pipe embedment depth, then place 1 ft. of filter sand.
- (6) Set the well protective pipe onto the firm bed of filter sand.
- (7) Add granular bentonite around the outside of the protective pipe only and hydrate it to 2 ft. lifts to the surface.
- (8) Concrete ground surface seals in regions where the ground freezes are not recommended. Frost heave will jack the concrete seal and the well protective pipe out of the ground.
- (9) Do not place bentonite between the protective pipe and the well casing.
- (10) If the monitoring well depth is such that both a minimum 2 ft. annular space seal and a minimum 5 ft. ground surface seal cannot both be placed, the ground surface seal may be shortened.
- (11) Record the depth to the bottom of the ground surface seal, also record the length and diameter of the well protective pipe.
- (12) The well protective pipe should stick up a minimum of 24 in. above the ground surface and should always extend above the top of the well.

- (13) The top of the well pipe must be within 4 in. of the top of the well protective pipe.
- (14) The well protective pipe should not extend into the filter pack.
- (15) The well protective pipe should be filled with filter sand to within 12 in. of the top of the well.
- (16) A weep hole may be drilled into the well protective pipe; a small vent hole should be cut or drilled into the well cap.

C. After Well Installation

- 1. Check for settlement of the ground surface seal; top off as necessary.
- 2. Label the protective casing with the well number.
- 3. Stick up wells: label the well cap inside and out with the well number.
- 4. Lubricate the well lock.
 - a. Do not use WD-40 or penetrating oils.
 - b. Remove the lock away from the well and lubricate it with liquid graphite.
 - c. Wipe off excess lubricant, allow the lock to "dry", then return it to the well.
- 5. Stick up wells in high traffic areas: consider placing bumper posts around the well.
 - a. Wood or steel, set in concrete or bentonite.
 - b. At least 8 ft. long with 4 ft. stick up.
 - c. Posts may be painted or flagged.
 - d. Do not paint the well protective casing.
- 6. Clean up the area: pick up trash, do not burn; pick up cuttings; use a broom, rake, or hose down the area.

SPECIFIC OPERATING PROCEDURES

**UPPER AQUIFER INVESTIGATION
American Chemical Service Inc.
Griffith, Indiana**

PIEZOMETER INSTALLATION PROTOCOL

Scope and Application: This method is applicable to installing piezometers.

I. PRE-FIELD CHECKLIST

- A. Health and Safety Plan with related instruments**
- B. Underground Utility Check: 5 to 7 day advance notice required**
- C. Off-Site access agreements completed**
- D. Statement of Work detailing sample types, sample intervals, drilling and sampling methods**
- E. Field boring logs (Montgomery Watson Standard)**
- F. Daily Drilling Summary**
- G. Unified Soil Classification System summary**
- H. Decon solutions, brushes, buckets**
- I. Soil jars (Laboratory Grade and Driller's Grade)**
- J. Jar labels**
- K. Driller contacted and informed**
 - 1. Health and Safety Plan**
 - 2. Utility check**
 - 3. Statement of Work/Sampling Plan**
- M. 150 foot tape measure**
- N. Pocket penetrometer**

- O. Soil knife/spatula
- P. Utility Knife
- Q. Well Construction Forms
- R. Well Development Forms

II. FIELD CHECKLIST

- A. Check for unmarked or uncleared utilities, drive around, walk around
- B. Check for overhead wires
- C. Drill rig access
- D. Health and Safety Briefing
- E. Borehole location correctly staked and labeled
- F. Steam clean drill rods, casing, bits, split-spoon samplers, hand tools, drill rig
- G. Count number of drill rods to determine the number used during drilling and therefore, the total depth drilled
- H. Confirm the correct well construction materials are present
- I. Prepare soil jars

III. SOIL BORINGS

Soil borings will be advanced using 4.25 inch inner diameter (ID) hollow stem augers (HSA). Soil samples will be collected using a 2-inch diameter split-spoon sampler at 2.5 ft sampling intervals (i.e. 1 to 2.5 ft, 3.5 to 5 ft, etc). Soil samples will be visually inspected and classified according to the Unified Soil Classification System (USCS).

A. Split Spoon Sampling

- 1. Inspect split spoon
 - a. Measure length of spoon from tip to shoe.

- b. Spoon tip must not be gouged, bent, or excessively worn
 - c. Spoon must have a check valve; the check valve should be free of soil and be able to seal.
 - d. Spoon tip may contain a spring sample catcher which is clean and in good working order.
 - e. Split spoon samplers should be cleaned between boring locations using steam cleaning. Split spoons will be washed between sampling intervals using a TSP/Liquinox wash followed by a distilled water rinse.
2. Handling Split Spoon Sample - Logging Soils
- a. Carefully open split spoon sampler. Do not slam the split spoon to open.
 - b. Recognize and disregard any soil plug, sluff, or blow-in at the upper portion of the sample.
 - c. Measure and record sample recovery.
 - d. Perform pocket penetrometer test on cohesive soils, if encountered.
 - e. Describe and record the soil sample in accordance with the Unified Soil Classification System (USCS).
3. At nested locations, the first borehole will be drilled and sampled to at least two-feet into the clay confining layer which underlies the surficial sand aquifer. Additional boreholes will be blind drilled to the required depth for well/piezometer installation.

IV. INSTALLATION OF PIEZOMETERS

Piezometers are constructed of either 2-inch or 1.5-inch diameter PVC material, and fitted with two-foot screens (piezometers installed to the base of the surficial aquifer) and five-foot screens (piezometers installed to intersect the water table).

Piezometers will be installed through 4.25-inch ID hollow stem augers. Piezometers installed to the base of the surficial aquifer will be constructed using 2-foot screens, with the screened interval extending to the base of the surficial sand aquifer. Water table piezometers will be constructed using five-foot screens installed to intersect the water table (i.e., the well screen will be placed so that approximately 2 feet of the well screen length is above the water table measured in the borehole).

A. Before Piezometer Installation

1. Inspect screen and riser pipe inside and out for cleanliness, defects, gouges, cracks: reject any failed pieces.
2. Accurately measure length of screen piece including blank sections.
3. Measure total length of slotted interval
4. Accurately measure length of each riser piece.
5. Count the number of riser pieces to confirm accurate total length of well.
6. Inspect bentonite chips or pellets: Bentonite chips or pellets should be 3/8" in size.

B. During Piezometer Installation

1. Determine depth of piezometer placement as total length of assembled well string minus height of well string to above ground surface.
2. Riser pieces should have water tight joints: either neoprene gaskets or Teflon tape. Do not use glue or solvent cement.
3. Accurately determine total piezometer depth.
 - a. Measure length of riser pipe piece cut off from the total length of well string.
 - b. Total well string length minus length of cut off piece equals total piezometer depth (TD) measured from top of casing (TOC).
 - c. The well top should stick up a minimum of 24 inches above the ground surface.
4. Install a temporary cap to prevent any materials from falling into the piezometer. Lower piezometer string down into the casing to the predetermined depth.
5. Following installation of the piezometer pipe through the augers, the augers will be pulled back to approximately 3 feet below ground surface to allow for natural cave-in of soils around the piezometer screen.
6. Bentonite Seal:
 - a. Use bentonite chips or pellets no larger than 3/8 inch in diameter when placing seal through water.
 - b. The bentonite seal will be installed to extend to the ground surface.

- c. Record the type, size, and volume of sealant placed.

C. After Piezometer Installation

1. Check for settlement of the ground surface seal; top off as necessary.
2. Label the PVC riser pipe with the piezometer number.
3. Lubricate the well lock.
 - a. Do not use WD-40 or penetrating oils.
 - b. Remove the lock away from the well and lubricate it with liquid graphite.
 - c. Wipe off excess lubricant, allow the lock to "dry", then return it to the well.
4. Clean up the area: pick up trash, do not burn; pick up cuttings; use a broom, rake, or hose down the area.

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APRIL 29, 1996 U.S. EPA LETTER



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

REGION 5

77 WEST JACKSON BOULEVARD

CHICAGO, IL 60604-3590

REPLY TO THE ATTENTION OF:

April 29, 1996

EXPRESS MAIL
AND BY FACSIMILE

Mr. Ronald Frehner
Project Coordinator - ACS NPL Site
Conestoga-Rovers & Associates
1801 Old Highway 8, Suite 114
St. Paul, Minnesota 55112

RE: Clarification of Disapproval of March 1996
Upper Aquifer Technical Memorandum;
American Chemical Service, Inc. Site;
Griffith, Indiana

Dear Mr. Frehner:

This letter serves to clarify the United States Environmental Protection Agency's (U.S. EPA) disapproval letter dated April 10, 1996, of the March 1996, Upper Aquifer Technical Memorandum submitted by Montgomery Watson on behalf of Respondents for the American Chemical Service, Inc. Site located in Griffith, Indiana (ACS Site) in accordance with the Unilateral Administrative Order (UAO or Order) (Docket V-W-95-C-C-260).

As you know, U.S. EPA and the Indiana Department of Environmental Management (IDEM) met with Respondents on April 23, 1996, to discuss the U.S. EPA disapproval of the Upper Aquifer Technical Memorandum and the proposed wells in accordance with Task 7A of the partially approved Pre-Design Work Plan. The Pre-Design Work Plan was partially approved by U.S. EPA on September 21, 1995, and modified on April 15, 1996; in that approval, U.S. EPA established a process of working through the complex hydrogeologic issues at ACS whereby screening level data would be gathered by the "tracer investigation", and then confirmatory data would be collected from monitoring wells.

This iterative process was established to derive a meaningful groundwater monitoring network, pre-design data to establish the pre-remediation conditions, the scope of the necessary upper and lower groundwater remediation and to determine the effectiveness of any groundwater extraction and treatment system.

